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ABSTRACTS OF CHEMICAL PAPERS PUBLISHED IN BRITISH AND FOREIGN JOURNALS.

PART II.

General and Physical Chemistry.

Relation between Luminous Energy and Chemical Energy. By Marcellin P. E. Berthelot (*Compt. rend.*, 1898, **127**, 143—160). —Attention is drawn to the fundamental distinction which exists between endothermic photochemical reactions, in which luminous energy is transformed into chemical energy, and those exothermic reactions in which the light acts merely as an auxiliary agent, the principal part of the change being accomplished by purely chemical agencies. The former class of reactions alone is adapted for the measurement of luminous energy. In this connection, the author has studied the behaviour of a number of substances when exposed to direct sunlight or to diffused daylight, and when placed in the dark. The substances were contained in sealed tubes, and in some cases, by surrounding them with coloured media, the effects due to different radiations were distinguished.

Nitric Acid.—The decomposition of concentrated nitric acid by the action of light at the ordinary temperature is similar to that which takes place in the dark, at 100°, and possibly at lower temperatures, the sole products being nitric peroxide, water, and oxygen. The reaction is caused principally by the blue, or so-called chemical, rays; it is endothermic and not reversible or, at least, not entirely so. The diluted acid is not affected by light, and acid of sp. gr. 1·365, corresponding with the composition $HNO_3 + 2\frac{1}{2}H_2O$, was found to have undergone no appreciable amount of decomposition after several weeks exposure. At this point, a state of equilibrium is reached between the forces due to luminous and chemical energies respectively. It is also to be noted that the nitric peroxide produced in the decomposition tends to absorb those radiations which were instrumental in its formation.

Iodic Acid.—Both iodic acid and iodic anhydride are stable in diffused light at the ordinary temperature, but are decomposed by direct sunlight with liberation of iodine and oxygen. The decomposition is analogous to that which is brought about by heat alone at about 300°, and is limited by the absorptive action of the iodine vapour and by the deposition of solid iodine on the surface of the compound. For this reason, the reaction, although accompanied by the absorption of a considerable amount of heat, is unsuitable for the measurement of luminous energy.

Hydrogen Iodide.—The decomposition of hydrogen iodide lies on the border line of exothermic and endothermic reactions, but the author inclines to the conclusion that it is accompanied by the development of heat $= 0{\cdot}4$ Cal. If solid iodine separates, the reaction is undoubtedly exothermic ($+6{\cdot}4$ Cal.). The decomposition is due to the blue and violet rays and takes place slowly in diffused light, more quickly in direct sunlight, with the intermediate formation of hydrogen periodide (HI_3 ?). Aqueous solutions of hydrogen iodide are not decomposed by direct sunlight, unless air or oxygen is present.

Hydrogen Bromide.—Gaseous hydrogen bromide is not affected by the action of light, even at 100°. This fact is in accordance with the observation, previously recorded, that the action of light accelerates the decomposition of water by bromine.

Various Gaseous Mixtures.—No action was observed in the case of the following systems when exposed to light, either in the dry or moist state: $CO_2 + 2H_2$; CO_2; $CO + 2H_2$; CO; $SO_2 + 3H_2$; $HNO_3 + H_2$; $CO + 8O_2$; $CO + O$; CO + air.

Metallic Oxides and Salts.—Red mercuric oxide undergoes decomposition more rapidly than the yellow modification, and the action is, in each case, much increased by the presence of moisture. Mercurous oxide, when exposed to light, yields a small quantity of metallic mercury and becomes yellow in parts, but no gas is evolved. No action was observed in the case of lead peroxide, silver oxide, and mercuric chloride, bromide, and iodide. Mercuric and mercurous acetates, exposed in vacuous tubes, blacken on the surface and evolve a little carbonic anhydride, especially when moist. These reactions, however, are exothermic and caused by the oxidising action of the salts.

Silver Haloids.—The decompositions which may occur are endothermic, both in the presence and absence of moisture. Since, however, the reactions are reversible, they are not suited for photochemical measurements.

According to these observations, the measurement of luminous energy by transformation into chemical energy is to be effected by means of endothermic reactions which are irreversible at the ordinary temperature. In order that the results may be additive, or proportional to the time of exposure, it is necessary to employ fluid systems admitting of uniform action throughout their mass. In any case, the chemical effect is a measure only of the particular radiations, varying for each substance, which are actually absorbed. In comparing the chemical effects of light and heat, it is pointed out that all decompositions may be effected by means of heat, whereas the action of light, and, usually, of particular radiations, only brings about certain reactions. N. L.

Influence of Association of Liquids on their Optical Activity. By L. Tschugaeff (*Ber.*, 1898, **31**, 2451—2454).—The optical activities and molecular volumes of four organic salts of menthol were determined, with the object of testing the validity of Crompton's views as to the relationship subsisting between the association and optical activity of organic liquids. The numbers obtained were as follows, where V_T = calculated molecular volume, and V_E = molecular volume observed.

	d 20°/4°	V_T	V_E.	$V_E - V_T$	$[M]_D$.
Phenylacetate ...	0·9874	271·4	277·5	+6·1	−190·7
Phenylpropionate	0·9851	287·5	292·4	4·9	−161·9
Metatoluate	0·9931	271·4	275·9	4·5	−241·0
Orthotoluate ...	0·9972	271·4	274·7	3·3	−231·3

It is clear that there is here no reason to assume association, and, whilst the difference between the calculated and observed molecular volumes of the phenylpropionate and metatoluate are practically identical, their molecular rotations are entirely different. It cannot be supposed, therefore, that the molecular rotations of the two liquids are dependent on their degrees of association.

Similar results have been obtained by Frankland and McCrae in the case of the ethereal salts of tartaric acid (Trans., 1898, 307). It seems probable, therefore, that the state of association of a liquid does not exercise a predominating influence on its optical activity.

Additional evidence is cited, showing the insufficiency of Crompton's view. Thus amylic alcohol is lævorotatory, whilst its ethereal salts are dextrorotatory, to an amount which at first increases with rise in the homologous series, and finally becomes constant. This, according to Crompton's view, is the result of decrease in the degree of association, which begins with the free alcohol and culminates in the salts with constant rotation; it would be expected, therefore, that any cause which lessens the state of association of the alcohol should alter its rotation in the sense of approaching that of the higher alkylic salts. It has been shown by Guye and Aston, however (Abstr., 1898, ii, 469), that amylic alcohol in the state of vapour or in dilute solution has a more powerful lævorotation than when in the state of liquid at a low temperature; and since the molecular weight, as determined by static and cryoscopic methods, has a normal value, association is excluded, and its disappearance has an effect opposite to that anticipated by Crompton's theory. A. L.

Compound Line-spectrum of Hydrogen. By R. S. Hutton (*Phil. Mag.*, 1898, [v], **46**, 338—343).—The author's results support the generally accepted conclusions that the compound line-spectrum of hydrogen is a true hydrogen spectrum, and render it probable that the disappearance of the compound line-spectrum in vacuum tubes that have been previously washed out by oxygen, as observed by Cornu, may be explained by the fact that traces of oxygen remained in the tube, such traces almost completely destroying the compound spectrum. H. C.

Appearance of the Cleveite and other new Gas Lines in the Hottest Stars. By SIR J. NORMAN LOCKYER (*Proc. Roy. Soc.*, 1897, **62**, 52—67. Compare Abstr., 1898, ii, 2).—This paper continues the discussion of the value of the relative intensities of certain lines in the spectra of stars as criteria of their relative temperatures, with special reference to those stars near the apex of the temperature curve. The relative behaviour of certain lines as the temperature increases or decreases is deduced by direct comparison of the spectra of some typical stars, as by this means an indication is obtained as to which lines are intensified and which thin out as the temperature changes, and thus affords a basis for the determination of the sequence of the hottest stars.

It is shown that, of the Cleveite gas lines (1) the gas *X* does not vary absolutely with helium; (2) gas *X* varies its intensity at a rate different from that of helium; (3) although helium and gas *X* reach their maxima nearly together, the maximum of gas *X* is short lived, whilst that of helium is prolonged. These facts indicate that helium and gas *X* are to be regarded as distinct substances.

A comparison of the principal and subordinate series of lines makes it clear that, in tracing the progress of gas *X* through the stars of increasing and decreasing temperature, the lines of the principal series, as tabulated in the laboratory, become of secondary importance; the first subordinate series becomes pre-eminent in intensity, and the second subordinate series almost entirely disappears, near the point of maximum temperature. In the case of gas *X*, as the principal series is not intensified to the same extent as the first subordinate series in passing from Rigil to Bellatrix, it is suggested that perhaps the molecules corresponding with the former series do not survive the higher temperatures. It is thought that as yet there is no reason to regard the three series of gas *X* or helium as representing different constituents, but three sets of molecules of different complexities. In view of the definite nature of the results which have been obtained, the author thinks that gas *X* should now be distinguished by a definite name, and suggests "asterium" as the most suitable.

In view of the probable existence of other new gases in the hottest stars, it becomes of importance to have a means of discriminating between gaseous and metallic lines. It is fair to assume that, in the nebulæ, the unknown bright lines will belong to gases, as in them the lines of hydrogen, helium, and asterium are found, but no indication of the enhanced lines of Fe, Mg, Mn, Si, &c., the existence of a moderately low temperature being thus indicated. Again, in α-Cygni, where the enhanced metallic lines are strong, the helium lines are once more strongly developed; hence the lines of gases which behave like helium in stars as well as nebulæ may be expected to be intensified in passing from α-Cygni through successively hotter stars. A table of lines behaving in this manner is given; these are $\lambda = 3912{\cdot}2$, 3994·7, 4040·6, 4069·7, 4071·7, 4075·7, 4088·7, 4094·7, 4104·8, 4114·8, 4172·6, 4253·6, 4267·6, 4314·6, 4345·6, 4415·2, 4541·8, 4566·8, 4574·8, 4613·8, 4643·8, 4650·9.

From a list of new lines observed by the author with gases from terrestrial sources, he extracts the following, which probably have counterparts in the hotter stars: $\lambda = 3929{\cdot}4, 3961{\cdot}6, 4002{\cdot}9, 4069{\cdot}7, 4072{\cdot}2, 4114{\cdot}6, 4309{\cdot}4, 4338{\cdot}0$. The lines observed in the spectra of gases from minerals may be divided into two groups, the first comprising those which are strong in α-Cygni, and diminish at higher temperatures, and the second, those which are absent or weak in α-Cygni, and become stronger with higher temperature. The lines of the first group behave like the enhanced lines of the metals, and at present it is impossible to say whether the corresponding stellar lines are produced by gases or are an accidental coincidence; in the case of the second group, however, there is much probability that they represent new gas lines.

A minute examination of the spectrum of Bellatrix has been made by Dr. W. J. S. Lockyer, with a view of ascertaining whether some of the still unknown lines might form a series. Fifty unknown lines are left after eliminating those due to hydrogen, helium, and asterium, and it is probable that two series are present, but the question awaits better photographs of the spectrum.

A comparison of the spectra of ζ Puppis, as given by Pickering (*Astrophysical Journal*, 4, 369), and of Bellatrix proves that they only differ markedly in the presence of those new lines in ζ Puppis which Pickering showed were computable from the formula representing the hydrogen spectrum using odd values of n instead of even. On the supposition that this new series of probable hydrogen lines was due to a transcendental temperature, attempts have been made to produce them, by means of high tension sparks in hydrogen, but without success.

In conclusion, the author's preliminary investigations have shown that, with increasing temperature, hydrogen is first visible, then helium and asterium appear nearly together, and, finally, unknown lines at wave-lengths 4088·7 and 4650·9, these last two being at a maximum when the lines of asterium have considerably decreased. It is still doubtful, however, whether Bellatrix on the one hand, or ϵ Orionis and ζ Puppis on the other, may be taken as typical of the hottest stars. A. L.

A Third Class of Electrode. By Robert Luther (*Zeit. physikal. Chem.*, 1897, **28**, 364—366).—A form of cell is designed in which there is obtained a reversible electrode of a metal which decomposes water, as, for example, the following—Lead in a mixture of calcium and lead sulphates in a solution of a calcium salt. In this case, the potential difference at the electrode is $\pi = K \log. k_2/(\mathrm{Pb}'')$, but $(\mathrm{Pb}'') \times (\mathrm{SO}''_4) = k_1$ and $(\mathrm{Ca}'') \times (\mathrm{SO}''_4) = k_2$, hence $\pi = K \log. k_3/(\mathrm{Ca}'')$. The availability of such a form of electrode is proved by the determination of the E. M. F. of chains containing such electrodes of zinc with those containing ordinary electrodes; the values only differed by 0·001 volt. It is evident that the salts employed must be only slightly soluble, and must form no double compounds or mixed crystals. L. M. J.

Electrical Oscillations. By Eilhard Wiedemann and Gerhard C. Schmidt (*Zeit. physikal. Chem.*, 1898, **27**, 343—344). (See Kauffmann, Abstr., 1898, ii, 550).—The authors had also found that characteristic spectra are produced by electrical discharges in organic compounds, and give the position of the limits and maximum intensity of the spectra given by a number of compounds of naphthalene, anthracene, &c. (Abstr., 1896, ii, 86). L. M. J.

Method for Determining the Resistance of Electrolytes. By Parker C. McIlhiney (*J. Amer. Chem. Soc.*, 1898, **20**, 206—209). —The method described, whilst not so accurate as that of Kohlrausch, is of advantage for making many readings in a short space of time. It consists in determining by a galvanometer, preferably a d'Arsonval, the potential difference between the ends of a known resistance placed in series with the resistance to be determined. The current is supplied by a gravity battery, and before passing through the electrolyte it is transformed into an alternating current by means of a rotatory pole changer, but the current passing through the known resistance is direct. When a current passes through two resistances in series, the fall of potential in each of them is proportional to its resistance. H. C.

Electrical Conductivity in Mixed Salt Solutions. By H. Hoffmeister (*Zeit. physikal. Chem.*, 1898, **27**, 345—353).—The quantity of an ion which passes across a section of the electrolyte is a function of the conductivity, valency, current strength, concentration, and ion velocity, and hence by determination of the increase of concentration of an ion in the anode or cathode liquid the actual concentration of the ions may be determined if the velocity is known. The author has in this manner determined the concentration of the silver and hydrogen ions in mixed solutions of silver nitrate and nitric acid, and compared the results with those calculated on an assumption of Rudolphi's dilution law. Similar experiments were performed with sodium acetate and acetic acid; in this case, owing to the slight dissociation of acetic acid, its addition has but little effect on the concentration of the sodium ions.

Note on above by Hans Jahn.—The above method affords a means of testing the validity of the dilution law which assumes that the ion velocity is not a function of the concentration. Some unpublished experiments indicate the connection $uC\sqrt{V}$ = constant where u is the ion velocity, C the concentration, and V the volume in which 1 gram molecule is dissolved. L. M. J.

Physico-chemical Investigation of Diazonium Salts, Diazonium Hydroxide, and Normal Diazotates. By William B. Davidson and Arthur Hantzsch (*Ber.*, 1898, **31**, 1612—1648).—In a previous paper (Abstr., 1895, ii, 516), it has been shown by one of the authors that the diazonium radicle, PhN⋮N, is strictly analogous to the ammonium radicle in its salt forming properties, and that diazonium must be regarded as a fully substituted ammonium of the quaternary type. This appears also from the investigation of the conductivity of the salts and the hydroxide. The temperature coefficients are found to accord with Arrhenius' rule for normal salts, salts of the smaller conductivity having the higher temperature coefficients. The molecular conductivity increases with the dilution exactly as in the case of potassium or ammonium salts. The rate of migration of the diazonium ion at 25°, $a = 45{\cdot}7$, compares with that given by the quaternary bases pyridinemethylium, $a = 44·3$, and tetramethylammonium, $a = 43·6$, but differs entirely from that of the primary phenylammonium, $Ph·NH_3$. The affinity constant of diazonium hydroxide at 0° is approximately 0·123, which is nearly 70 times greater than that of ammonium hydroxide, and even greater than that of piperidinium hydroxide. The rate of saponification of diazonium hydroxide at 0° and $v = 128$ is about one-half that of sodium hydroxide. From the rate of saponification, diazonium hydroxide would contain at 0° and $v = 128$ about 43 per cent. of hydroxyl ions; the number obtained from the conductivity is about 33 per cent. Hence diazonium hydroxide would appear to be about one-third dissociated in solutions of this concentration.

In the undissociated state, the diazonium hydroxide is present chiefly in the form $OH·NPh·NH·OH$ intermediate between the true diazonium and the syn-diazo-hydroxide. This would appear from the acid character of the solutions of diazonium hydroxide, a definite heat of neutralisation with sodium hydroxide being observed exactly as in the case of an acid. This is fully explained by the oxime-like structure of the syn-diazo-hydroxide. The syn-diazotates undergo hydrolysis to a remarkable and abnormal extent in dilute solution, the hydrolysis increasing more rapidly with the dilution than is the case with other salts decomposed by water. This is probably due to the formation of the intermediate compound already alluded to and the transformation of this into diazonium hydroxide. H. C.

A New Fixed Point in Thermometry. A Proposal for a Normal Room Temperature. By WILHELM MEYERHOFFER and A. P. SAUNDERS (*Zeit. physikal. Chem.*, 1898, **27**, 367—368).—The transition point of a mixture of sodium chloride and sodium sulphate in molecular proportion is 17·9°, and is thus approximately the ordinary room temperature. The advantages claimed by Richards for the transition point of sodium sulphate as a fixed point hold also in this case, and the authors suggest that it might be employed for a *normal* room temperature (Abstr., 1898, ii, 555). L. M. J.

Latent Heat of Evaporation of Zinc and Cadmium. By WILLIAM SUTHERLAND (*Phil. Mag.*, 1898, [v], **46**, 345—346).—The usual thermodynamical equation for the latent heat of evaporation of a gram of liquid at absolute temperature θ and of volume v_1 into saturated vapour of volume v_3 at saturation pressure p, $\lambda = \theta\frac{dp}{d\theta}(v_3 - v_1)/J$, has been so thoroughly verified that it furnishes an experimental method of determining λ without the necessity of direct calorimetric measurements. From the relation between p and θ for zinc and cadmium determined by Barus, the author calculates the heats of vaporisation of gram-molecules of these metals as liquids, in kilocalories 28·3 for zinc and 29·6 for cadmium. H. C.

Freezing Point of Aqueous Solutions of Sodium Mellitate. By W. W. TAYLOR (*Zeit. physikal. Chem.*, 1898, **27**, 361—363).—The molecular depression of the freezing point was determined for various solutions of the above salt which, for complete dissociation, should form seven ions. The most dilute solutions (0·0018 gram-mols.

per litre) gave a depression of 5·92 × 1·87°, and the most concentrated (0·277 gram-mols. per litre) 3·77 × 1·87°. L. M. J.

Cryoscopic Behaviour of the Picrates. By GIUSEPPE BRUNI and R. CARPENÉ (*Gazzetta*, 1898, **28**, ii, 71—83).—The authors have examined the cryoscopic behaviour of the picrates of naphthalene, phenanthrene, anthracene, *α*- and *β*-naphthol, phenylcoumalin, *α*-naphthylamine, 2′-methylindole, 2′ : 3′-dimethylindole, 2′-methyl-3′-ethylindole, carbazole, 2′-methyldihydroindole, *αββ*-trimethylindolenine, *nββ*-trimethyl-*α*-methyleneindoline, *nββ*-triethyl-*α*-methyleneindoline, *ββ*-diethyl-*α*-methylindoline, 2′ : 4′-dimethylquinoline, and pseudopelletierine, using acetophenone as the solvent.

The picrates of the hydrocarbons, phenols, and lactones are completely dissociated in acetophenone solution; those of the indoles and carbazoles are wholly dissociated in dilute solution, but not in more concentrated ones. No sharply defined differences in cryoscopic behaviour distinguish additive compounds of picric acid from the picrates of organic bases; the degree of dissociation diminishes as the basicity of the base increases. W. J. P.

New Method of Determining the Vapour Pressures of Solutions. By E. B. H. WADE (*Proc. Roy. Soc.*, 1898, **62**, 376—385). —A detailed description of the apparatus employed by the author in carrying out the determinations recorded in a previous paper (see Abstr., 1898, ii, 15). H. C.

Vapour Pressure of Hydrated Crystals. By GUSTAV TAMMANN (*Zeit. physikal. Chem.*, 1898, **27**, 323—336).—Andreæ has shown that the vapour pressure of hydrated salts is, between wide limits, independent of the water content, and changes suddenly at points corresponding with definite hydrates (Abstr., 1891, 981). In cases of incomplete equilibrium, however, the vapour pressure may change continuously with the removal of water, and this occurs for all the compounds examined by the author, which are all hydrated silicates, namely gmelinite, phacolite, chabazite, leonhardite, saumontite, phillipsite, gismondine, okenite, natrolite, scolesite, pyrophyllite, thomsonite, prehnite, uranite, and hyalite, and curves of vapour pressure against water concentration are given. The change of hydration is usually reversible, but if the dehydration is carried on until the pressure falls below about 1 mm., the hydration does not again reach its original value. L. M. J.

Dehydration of Crystalline Salts. By THEODORE W. RICHARDS (*Zeit. anal. Chem.*, 1898, **37**, 583—584, from *Proc. Amer. Acad. Arts and Sci.*, **33**, 23).—In a desiccator containing phosphoric anhydride, crystals of barium chloride lose one molecule of water rapidly, but the second molecule more slowly. Most salts which crystallise with a small number of molecules of water behave similarly, but those with a large amount of water of crystallisation give it up in a gradual and continuous manner. It is, however, suggested that, by employing dehydrating agents of lower hygroscopic character, the different tensions of the individual water molecules might be recognised by the rate at which loss of weight proceeded. M. J. S.

Velocity of Diffusion of Gases through Water and through Agar Jelly. By GUSTAV HÜFNER (*Zeit. physikal. Chem.*, 1898, **27**, 227—249).—Exner's rule, that the velocities of diffusion of gases through water are inversely proportional to their densities, is not obeyed by hydrogen and ammonia when referred to carbonic anhydride, whilst the agreement in the cases of oxygen and nitrogen is only apparent (Abstr., 1897, ii, 249), as the temperature of observation was different for the two latter gasses. The velocity of diffusion of ammonia was, therefore, determined with the aid of a hydrophane division as explained in the previous paper (*loc. cit.*). The values obtained were, $k_0 = 0·727$; $k_5 = 0·822$, $k_{10} = 0·953$, $k_{15} = 1·106$ and $k_{20} = 1·250$. These results, although totally different from those of Müller, agree well with those of Voigtländer (Abstr., 1889, 817) for the diffusion in agar jelly. The value is, however, only one-half that calculated from the diffusion velocity of carbonic anhydride by means of Exner's law, and thus indicates a double molecule. The diffusion velocity of hydrogen in agar jelly was found to be $k_{10} = 3·75$, which is in accord with the values found by the hydrophane method, $k_{16} = 4·09$, $k_{21} = 4·45$. Assuming the influence of temperature to be given by the expression $k_t = k_0 (1 + at)^2$ the coefficient a was found to be 0·010295 in the case of carbonic anhydride. From the diffusion velocity of the latter, those of a number of acids, salts, and bases are calculated, but the values so found do not agree with the determinations of Voigtländer. In the case of the alkali hydroxides, the velocity increases with the molecular weight. The author also calculates the association necessary to give values in accord with the determinations, and finds that, in formic acid, three molecules, in acetic acid, five molecules, and in butyric acid seven molecules are associated. L. M. J.

NOTE.—The diffusion of an undissociable compound cannot, however, be legitimately compared with that of an electrolyte, so that deductions drawn from such a comparison are invalid. L. M. J.

Osmotic Pressure. By CLARENCE L. SPEYERS (*J. Amer. Chem. Soc.*, 1898, **20**, 579—585).—When a solution and the pure solvent are separated by a semi-permeable diaphragm, at equilibrium the counter pressure preventing the entrance of the solvent into the solution, is commonly given as equal to hs on the unit surface, h being the height of the column of liquid and s the density of the solution whose counter pressure balances the osmotic pressure. The author argues that, as the diaphragm receives the full pressure of the solute, the hydrostatic pressure which prevents the entrance of the solvent comes only from the column of pure solvent in the solution, and that the quantity s given above should apply to the pure solvent and not to the solution. H. C.

Solubility of Mixed Electrolytes of Two Ions containing no Common Ion. By ARTHUR A. NOYES (*Zeit. physikal. Chem.*, 1898, **27**, 267—278).—For the complete determination of the solubility of a salt *C.D.* in a solution of *A.B.* of known concentration, the solution of nine equations containing nine unknown quantities is necessary. This, although possible, is extremely tedious, and the author, therefore, shows how the determination may be simplified very greatly. Three cases occur, (1) where both secondary compounds, that is, *B.C.* and *A.D.*, are highly dissociated, (2) where one of these compounds and *C.D.* are highly dissociated, and (3) where only one of the secondary compounds is highly dissociated. The accuracy of the expressions are proved in the several cases by solubility determinations for a mixture of (1) thallium chloride and potassium nitrate, (2) silver benzoate and nitric acid, (3) silver benzoate in monochloracetic acid. L. M. J.

Solubility of Salts of a Weak Acid in a Strong Acid. By ARTHUR A. NOYES and DAVID SCHWARTZ (*Zeit. physikal. Chem.*, 1898, **27**, 279—284).—The experiments were made in order to test the validity of the expressions deduced by Noyes (preceding abstract). Silver benzoate was dissolved in solutions of nitric and chloracetic acids of various concentrations and the values found compared with those calculated by Noyes' expressions. The general accord of the result is seen from the following examples.

Nitric acid.			Chloracetic acid.		
Concentration.	Sol. found.	Sol. calc.	Concentration.	Sol. found.	Sol. calc.
0·004435	0·01395	0·01406	0·0000	0·01144	—
0·008915	0·01715	0·01706	0·003935	0·01385	0·01386
0·01783	0·02351	0·02396	0·00787	0·01612	0·01588
0·02674	0·03071	0·03159	0·01574	0·02093	0·02117

L. M. J.

Aqueous Solutions of two Salts with one Common Ion. II. By C. HOITSEMA (*Zeit. physikal. Chem.*, 1898, **27**, 312—318).—The solubility isothermals at 20·1 were determined for mixtures of (1) salicylic acid and sodium salicylate, (2) hippuric acid and potassium hippurate. In both these cases, a double salt occurs but no mixed crystals or complex molecules, and the solubility phenomena are in accord with the general form of curve for such a case deduced previously by the author (Abstr., 1898, ii, 157). L. M. J.

Cause of the Dissociative Power of a Solvent. By JULIUS W. BRÜHL (*Zeit. physikal. Chem.*, 1898, **27**, 319—322).—It has been shown by Cady that liquid ammonia possesses a great dissociative power, probably equal to that of water (Abstr., 1898, ii, 203). Solvents of high dissociative power have also a high dielectric constant, and are usually liquids consisting of polymerised molecules. Hitherto, the dissociative power has been regarded as chiefly dependent on the existence of oxygen, and especially of hydroxyl groups, and the author considers it due to the quadrivalent nature of oxygen (*vide* Abstr., 1897, ii, 198), which hence in water and many other compounds is unsaturated and thus causes the separation of the ions and the polymerisation of the compound. The property of passing from a lower to a higher valency is also possessed by nitrogen, and the dissociative power of ammonia is probably due to this, it being noteworthy that many other nitrogen compounds cause dissociation, for example, the fatty nitriles, nitro-ethane, aniline, &c. (Dutoit and Aston, Abstr., 1897, ii, 546). For the same reason, the author considers it probable that liquid ammonia is polymerised and has a high dielectric constant. The unsaturation is different in kind from that of doubly linked carbon, but probably liquid acetylenes would also possess dissociative power. L. M. J.

Validity of the Dilution Law. Reply to Objections of Noyes. By J. J. VAN LAAR (*Zeit. physikal. Chem.*, 1898, **27**, 337—342).—The objections raised by Noyes to the author's expressions (compare Abstr., 1898, ii, 158) are unfounded, and Noyes' own expressions are almost identical with the author's. The validity of the deduced expressions is illustrated by a comparison of the calculated values, with those found, for the heat of dilution in the case of silver acetate, propionate, butyrate, and orthonitrobenzoate. L. M. J.

Solubility of Iodine in Dilute Solutions of Potassium Iodide. By ARTHUR A. NOYES and J. SEIDENSTRAKER (*Zeit. physikal. Chem.*, 1898, **27**, 357—360).—Jakowkin's experiments (Abstr., 1894, ii, 271) indicate that, in its solutions in aqueous potassium iodide, the iodine is present as potassium tri-iodide, but this is not in agreement with the fact that the addition of water to the saturated solution causes a precipitation of iodine, for since the active mass of the iodine must here be constant $(KI_3) = k\ (KI)$, and dilution should cause no precipitation as the ratio is unaltered.* Jakowkin's results hence probably only extend to moderately dilute solutions. The authors have, therefore, determined the solubility of iodine in dilute solutions of potassium iodide and compared the quantity of assumed tri-iodide with that of remaining iodide. The ratio is approximately constant, so that for solutions from 0·1 to 0·005 N., Jakowkin's results are confirmed. L. M. J.

*NOTE.—This conclusion is incorrect, inasmuch as proportionality only exists between the tri-iodide and *undissociated* potassium iodide and the concentration of the latter decreases on dilution, so that precipitation may occur. L. M. J.

Properties of Liquid Mixtures. By R. A. LEHFELDT (*Phil. Mag.*, 1898, [v], **46**, 42—59).—The vapour pressures of mixtures of any two of the following four liquids were determined by the dynamic method: benzene, toluene, carbon tetrachloride, and alcohol. When the vapour pressures are plotted against the molecular percentages, the difference between the alcohol curves and those of the normal liquids is most marked, for whilst mixtures of carbon tetrachloride and benzene, or carbon tetrachloride and toluene, have a vapour pressure never very different from that which would be obtained by interpolation from the pressures of the pure substances, both mixtures containing alcohol show a maximum—a very flat one. In the case of alcohol and benzene, it occurs at about 40 per cent. (molecular) of alcohol, and is 406 mm., being $406/(271 + 220) = 83$ per cent. of the sum of the pressures of the pure substances, whilst for alcohol and toluene it is at about 74 per cent. of alcohol, and has the value, 249 mm., which is $249/(93+220)=80$ per cent. of the sum of the pressures. If q is the ratio of the masses of the two substances present in the liquid, and t is their ratio in the vapour, for normal liquids the relation $\log t=\log k+r \log q$, where k and r are constants, holds for mixtures which do not contain a very small proportion of either constituent. For mixtures containing alcohol, the relations between $\log t$ and $\log q$ are very far from linear. Linebarger's rule, that the partial pressure of benzene and toluene in mixtures is simply proportional to the molecular percentage present, is not found to hold good. H. C.

Speed of Coagulation of Colloidal Substances. By CHARLES E. LINEBARGER (*J. Amer. Chem. Soc.*, 1898, **20**, 375—380).—Solutions of many colloids can be made to coagulate or gelatinise by the addition of a mere trace of certain substances; the striking analogy between this phenomenon and that of crystallisation has often been insisted on. If there is a true analogy, the addition of a small amount of a substance having the power to start coagulation in one part of a colloid solution should result in the spread of the coagulation at a certain rate throughout the whole solution, just as happens in the case of crystalloids in supersaturated solution. Experiments were made with colloidal ferric hydroxide, with silicic acid, and with egg-albumin which seem to prove that coagulation started in one part of a solution does not necessarily spread through the whole body of the solution. The author concludes that it is extremely improbable that colloid solutions are comparable with supersaturated solutions. H. C.

Absorption. Formation of Colloids, and their Structure. By JACOBUS M. VAN BEMMELEN (*Zeit. anorg. Chem.*, 1898, **18**, 14—36. Compare Abstr., 1897, ii, 137).—The formation of a colloid is the separation of a solution into two liquids, of which the one, the hydrogel, has a greater viscosity than the other, and forms a network which retains the solution partly absorbed and partly inclosed in the interstices. The conversion of the hydrogel into a glassy or horn-like substance is a continuous process depending on various conditions, such as the influence of a third substance, time, and the evaporation of the solution. The conversion of a colloid into a colloid with another liquid, the osmotic properties, the absorption, the expulsion of liquid by pressure, the formation of interstices, the continuous manner in which the contained liquid is evaporated by the influence of temperature and vapour tension, and the evaporation of this liquid, all take place in accordance with the view that the hydrogel is a cell-like structure of network. E. C. R.

Inflammability of Thin Layers of Explosive Gases. II. By FRIEDRICH EMICH (*Monatsh.*, 1898, **19**, 299—320. Compare Abstr., 1897, ii, 309).—The explosion tube has been altered so that it has a capacity of only a few cubic centimetres; with this apparatus, the air or the products of combustion may be completely removed in a few minutes.

With mixtures of hydrogen and chlorine, it is found that the mixture which is most readily inflammable is that which contains only half as much hydrogen as is required for complete combustion. It has also been shown that the inflammability is practically proportional to the pressure. Mixtures of methane and of oxygen have also been investigated, the oxygen being obtained by heating potassium chlorate in a copper tube, and the methane by Gladstone-Tribe's method. The mixture which is most readily inflammable is the one containing 1 volume of methane to 3 volumes of oxygen. With mixtures of carbonic oxide and oxygen, it has been found that small quantities of water vapour have an immense influence on the inflammability of the mixture; by increasing the amount of water from 0·25 to 0·5 per cent., the inflammability increases some 300 per cent. For this reason, the experiments have been conducted with mixtures of carbonic oxide and oxygen saturated with moisture. The mixture which is most readily inflammable is that which is completely combustible, namely, 2 volumes of carbonic oxide to 1 of oxygen.

J. J. S.

Reactions in Mixtures of Alcohol and Water. By WLADIMIR A. KISTIAKOWSKY (*Zeit. physikal. Chem.*, 1898, **27**, 250—266).—The reaction velocity for the hydrolysis of an ethereal salt in aqueous alcohol is given by the equation $dx/dt = k(a-x) - k_1x$, since the concentration of alcohol and water may be regarded as constant. The values of k and k_1 are given by the expressions $1/t \times x/a \times \log(X/\overline{X-x})$ and $1/t \times (a-X)/a \times \log(X/\overline{X-x})$, where X is the final equilibrium value of x. For the formation of the ethereal salt, the expressions are precisely similar. The values of the two constants were calculated from both the rates of formation and of decomposition of ethylic acetate and ethylic oxalate, hydrochloric acid being used as hydrolyser, and were in all cases concordant. The values are independent of the initial concentration of the organic acid, but vary considerably with the alcoholic concentration of the solvent. The velocity at first decreases with increasing percentage of alcohol, but for concentrations above 70 per cent. it again increases. For monochloracetic acid, the value $k + k_1$ is less than that for acetic acid, and for the di- and tri-chloracetic acids no results could be obtained, the behaviour of these being closely analogous to that of inorganic acids. When an acid is used as hydrolyser, the velocity is approximately proportional to the concentration of this acid, but when none is employed, the values of k and k_1 are functions of the concentration of the organic acid, and decrease rapidly with increasing percentage of alcohol.

L. M. J.

Velocity of Hydrolysis of Alkylic Phosphates. By JACQUES CAVALIER (*Compt. rend.*, 1898, **127**, 114—115).—In studying the hydrolysis of these ethereal phosphates, the author dissolves one molecule of the salt in 10 litres of water at 88°. Under these conditions, the decomposition obeys the law for monomolecular reactions. The three methylic phosphates are hydrolysed more rapidly than the corresponding ethylic salts. When trimethylic phosphate is employed, it is found that the first methyl group is removed most rapidly, whilst the velocity of hydrolysis of the second is least, and that of the third has an intermediate value. Similar velocities are obtained in the case of triethylic phosphate. This unexpected result does not hold for the di- and mon-allylic phosphates, for the latter is decomposed less rapidly than the former; the triallylic compound, being insoluble in water, could not be employed in these experiments. The velocity of hydrolysis varies greatly with the temperature; at 44°, it is 100 times less than at 88°.

The trialkylic salts are far more rapidly hydrolysed by bases than by water; on the other hand, the metallic salts of the di- and mon-alkylic phosphates are scarcely decomposed either in alkaline or aqueous solutions even at 90°. G. T. M.

Chemical Equilibrium between Amalgams and Solutions. By A. Ogg (*Zeit. physikal. Chem.*, 1898, **27**, 285—311).—If mercury and an aqueous solution of silver nitrate are shaken together, equilibrium is finally attained between silver nitrate, mercurous nitrate, and the amalgam. In this case, since the concentration of the mercury is practically constant, if a is the equivalent concentration of the silver nitrate, b that of the mercurous nitrate, and c that of the silver in the amalgam, then $a/bc =$ constant, if the mercury ions are univalent, and $a/c\sqrt{b} =$ constant, if the ions are bivalent. The latter equilibrium equation is that which actually obtains, the constancy of the first expression found in the author's previous paper (Abstr., 1897, ii, 366) being due to insufficient change in the concentration of the mercurous salt; the mercurous ions hence are $\dot{\mathrm{Hg}} - \dot{\mathrm{Hg}}$. If sufficient silver nitrate be used, a saturated solid amalgam is formed, and the active mass of the silver becomes constant, the equilibrium equation must reduce to $a/\sqrt{b} =$ constant, and this result was experimentally verified. The reverse equilibrium between silver and mercurous nitrate could not be attained, and it is probable that only surface amalgams are produced, even when the silver is present as a very fine powder. In the equilibrium of mercury, mercurous and mercuric nitrates, the ratio of the concentrations of the two salts is constant, a result again confirming the bivalency of the mercurous ions. This is also further established by the determination of the E. M. F. of cells consisting of two mercury electrodes in solutions of mercurous nitrate of concentration 1 : 10 respectively; the E. M. F. reduces to $0·058/n$ volts where n is the valency of the ions, and was found to vary from 0·0265 to 0·0305. Conductivity determinations proved that dilution produces a change of dissociation equal to that produced in solutions of lead nitrate, whilst freezing point experiments also support the formula $Hg_2(NO_3)_2$, so that there appears but little doubt concerning the structure of mercurous salts. The solution tension of mercury is very nearly equal to that of silver, and the difference of potential between reversible electrodes of silver and mercury changes sign by dilution of the salts. The vapour pressure of amalgams containing excess of mercury is very nearly equal to that of pure mercury, but falls considerably when the composition of the amalgam reaches Ag_3Hg_4. Experiments also prove that this amalgam is in equilibrium with mercury; from the temperature coefficient of the equilibrium constant, the mean value of 7336 cals. is obtained for the heat of formation of the solid amalgam, the different values agreeing satisfactorily. The polarisation E. M. F. is very nearly equal for solutions of silver and mercurous nitrates, but is lower for mixtures than for either of the pure solutions. L. M. J.

Equilibrium in the System: Water, Ammonium Chloride, Ferric Chloride. By E. C. J. Mohr (*Zeit. physikal. Chem.*, 1898, **27**, 193—221).—During the crystallisation of solutions containing ammonium chloride and ferric chloride, crystals are obtained containing both salts, and Schroeder van der Kolk considered these to be an isomorphous mixture of ammonium chloride with a regular hydrated ferric chloride (Abstr., 1893, ii, 280). This view was, however, contested by Retgers (Abstr., 1894, ii, 85), and the author therefore reinvestigated the equilibrium relations of the systems. Solubility determinations were made at 15°, 25°, 35°, and 45°; four phases may occur, (1) hydrated ferric chloride, (2) Fritsche's double salt, $FeCl_3,2NH_4Cl,H_2O$, (3) mixed crystals, (4) ammonium chloride. The ammonium chloride content at the triple point (1·2), and the ferric chloride content at the triple point (2·3), are respectively almost unaffected by temperature, so that the triple-phase curves cut at about $-15°$ probably, where the double salt phase must disappear. The composition of the mixed crystals deposited from various solutions was determined, and although the percentage of iron in the crystals increased with that in the solution, no regular results could be obtained. Microscopic examination of the crystallisation of ferric chloride solutions showed that the regular crystals of Kolk are best formed in an impure atmosphere and are probably due to the presence of ammonia, whilst the quantity formed by the crystallisation of mixtures increases with the quantity of ammonium chloride added; analyses gave results agreeing with $NH_4Cl,2FeCl_3,4H_2O$. The crystals are isotropic, the form being usually a cube with also the faces O and ∞O. Another double salt, in the form of olive-brown needles, probably rhombic, was found, possessing the composition $FeCl_3,NH_4Cl$, but it soon changes to the ordinary double salt. The author is unable to draw any definite conclusion regarding the composition of the mixed crystals, but considers them to most probably consist of ammonium chloride containing dissolved Fritsche's double salt.

L. M. J.

Velocity of Crystallisation. II. By Friedrich W. Küster (*Zeit. physikal. Chem.*, 1898, **27**, 222—226. Compare Abstr., 1898, ii, 330).—The velocity of crystallisation is the velocity with which the surface of a growing crystal extends into the liquid, and is only proportional to the velocity with which the limit of crystallisation extends, when the arrangement of the crystals remains constant. This is the case with moderate undercooling, when Tammann's results show that the velocity is proportional to the undercooling. This does not follow theoretically from Tammann's assumption, and has to be explained by an unknown "influence of the crystals on the liquid," but the author considers no theory valid which does not predict this proportionality. The author again contests Tammann's supposition that the melting point temperature prevails at the limiting surface; this could only be the case when the convergency temperature (Nernst and Abegg, Abstr., 1895, ii, 155) and melting point are equal (Abstr., 1898, ii, 425).

L. M. J.

Microscopic Examination of Crystals. By **J. L. C. Schröder van der Kolk** (*Zeit. anal. Chem.*, 1898, **37**, 525—580).—This paper is a highly condensed account of the employment of the polarising microscope in the examination and identification of crystalline substances. The greater part of it, dealing with the principles of crystallography and the theory of polarised light, presents no novelty, but many useful practical hints are interspersed amongst well-known matter. Thus, a convenient method of crystallising substances in the cold consists in placing a drop of the solution in the middle of a thin cover-glass, and inverting this over a deep cavity in a glass slide, with a drop of concentrated sulphuric acid at the bottom, so as to form a micro-desiccator, which can be placed on the stage of the microscope. The same apparatus serves for treating substances with the vapours of volatile liquids whilst under observation. For ascertaining the refractive index of a crystal, it is moistened with liquids of different refractive indices, and that liquid is selected which, by suppressing total refraction at the edges of the crystal, renders it invisible. A table of appropriate liquids is given. A valuable means of distinguishing uniaxial from biaxial crystals is afforded by mounting them on the plane face of a glass hemisphere, which is supported by its convex surface in the opening of the microscope stage. It is then possible to give a needle-shaped crystal, which lies in the centre of the field of view, a movement of rotation round its own axis, whilst keeping it both in the centre of the field and in focus. Finally, detailed descriptions are given of the appearance exhibited by about 50 common crystalline substances.

M. J. S.

A New Asbestos Filtering Tube. By **Adolf Goske** (*Chem. Zeit.*, 1898, **22**, 21).—The improved filter may be recommended on account of the small amount of asbestos required. Its essential part is a hollow glass ball with two small holes in its upper part, and drawn out at the bottom. The top is covered with a layer of asbestos about 5 mm. thick, and a sufficient quantity of abestos fibre suspended in water is poured over it. A filter pump is used.

L. de K.

Lubricants for Glass Stopcocks. By **Francis C. Phillips** (*J. Amer. Chem. Soc.*, 1898, **20**, 678—681).—The author points out that a good lubricant for stopcocks should satisfy the following requirements. It should adhere to the glass and not be loosened by water. It should be little affected by changes of temperature. It should not be saponified by alkali, and be sufficiently translucent to render visible any clogging of the hole in the stopcock plug while in use, and to show whether air spaces occur between the plug and the walls of the stopcock.

Two mixtures are recommended: (1) melt 70 parts of pure caoutchouc and stir in 25 parts of spermaceti and 5 parts of vaselin; in winter, a little more of the latter should be used; (2) 70 parts of pure, fresh caoutchouc is melted, and 30 parts of unbleached beeswax is stirred in. L. DE K.

Inorganic Chemistry.

Electrolytic Formation of Hydrogen Peroxide. By FRITZ HABER and S. GRINBERG (*Zeit. anorg. Chem.*, 1898, **18**, 37—47).—The authors, on repeating their experiments on the electrolysis of hydrochloric acid (Abstr., 1898, ii, 215 and 365), find that there is no formation of hydrogen peroxide, as previously stated. The test which they employed consisted in shaking the electrolyte with mercury, and then treating with titanic acid. They now find that the small quantity of hydrogen peroxide previously detected is produced by the action of the air and the finely divided mercury during the filtration. Experiments with platinum and gold electrodes show that if hydrogen peroxide is formed, it is destroyed by a secondary reaction, which takes place according to the equation $H_2O_2 + O = H_2O + O_2$, and such a small quantity remains undecomposed that it is not possible to detect it. E. C. R.

Reactions of Metallic Fluorides. By EMMANUELE PATERNÒ and UGO ALVISI (*Gazzetta*, 1898, **28**, ii, 18—24).—Those metallic oxalates which are sparingly soluble or insoluble in water are less soluble in hydrofluoric acid than in solutions acidified with hydrochloric or sulphuric acid.

On adding oxalic acid to a hydrogen fluoride solution of cupric fluoride, cupric oxalate, $2CuC_2O_4 + H_2O$, separates, and only traces of copper remain in solution. Although solutions of manganese chloride, nitrate, or sulphate in the corresponding acid are not precipitated by oxalic acid, yet on adding oxalic acid to a hydrogen fluoride solution of manganese fluoride and warming, a granular, white precipitate of manganic oxalate, $MnC_2O_4,2H_2O$, is obtained, and only traces of manganese remain in solution. Oxalic acid does not give a precipitate with mercuric chloride solution, but throws down mercuric oxalate from a solution of mercuric fluoride in hydrofluoric acid.

On heating powdered fluorspar with concentrated oxalic acid solution on the water-bath, the fluorine is slowly but wholly eliminated; the same occurs with magnesium fluoride and the fluorides of the cerite earths, yttria, thoria, &c.; this fact may be applied in the analysis of incandescent gas-lamp mantles. Concentrated tartaric acid solution decomposes fluorspar completely on the water-bath, although more slowly than oxalic acid.

Sulphurous anhydride acts on cupric fluoride, depositing Chevreul's salt of the composition $Cu_2SO_3,CuSO_3 + 2H_2O$ in minute, red crystals; the precipitation is, however, incomplete. An acid solution of silver fluoride is precipitated by arsenates, chromates, nitrites, platinochlorides, and sulphurous acid. W. J. P.

Reactions of Fluoro- and Fluoroxy-salts. By EMMANUELE PATERNÒ and UGO ALVISI (*Gazzetta*, 1898, **28**, ii, 24—29).—On treating, with aqueous oxalic acid, solutions of the silicofluoride, fluoroxyuranate, fluoroxytungstate, fluoroxymolybdate and the hydrogen fluoride of potassium, potassium quadroxalate separates and the corresponding fluoro- or fluoroxy-acid remains in solution; the silicofluorides of cerium, lanthanum, yttrium, &c., behave similarly, all the fluorine being eliminated from the salt.

On heating cryolite with concentrated oxalic acid solution on the water-bath, hydrogen fluoride is evolved, the aluminium fluoride being first decomposed and subsequently the sodium fluoride; similarly, on passing steam over red-hot cryolite, alumina, hydrogen fluoride, and sodium fluoride are first formed, and in a second stage of the reaction the sodium fluoride is attacked by the water vapour. Triplite is also decomposed by heating with oxalic acid solution.

Tartaric acid in aqueous solution also decomposes potassium silicofluoride and cryolite. W. J. P.

Ozone. By ALBERT LADENBURG (*Ber.*, 1898, **31**, 2508—2513).—Ozonised oxygen is condensed by means of liquid air and then allowed to partially evaporate, by which the residue is rendered much richer in the less readily volatile ozone. This operation is again repeated and the ozone finally allowed to evaporate; in this way, a gas is obtained which contains 86·16 per cent. by weight of ozone, and has a density of 1·3698 as compared with oxygen, the density being calculated from the rate of effusion determined in Schilling's apparatus. From these data, it follows that the density of pure ozone would be 1·456 as compared with oxygen, whereas the theoretical density is 1·5.

Ozone is not so soluble in water as is usually supposed, since at the normal pressure and ordinary temperature, water only absorbs 0·01 volume or 0·00002 part by weight.

An attempt was made to determine the boiling point of ozone by condensing ozonised oxygen, allowing the oxygen to evaporate, and then ascertaining the temperature at which the residual ozone evaporated. The oxygen volatilised at $-186°$ leaving 4—5 c.c. of an almost black opaque liquid. The temperature as indicated by the thermometer then rose to $-125°$, at which point the apparatus exploded violently, so that this can only be taken as a lower limit. A. H.

Ogier's Sulphur Oxychloride. By RUDOLPH JOH. KNOLL (*Ber.*, 1898, **31**, 2183—2185).—This alleged compound, S_2OCl_4 (Abstr., 1882, 694), is in reality a mixture of sulphur dichloride, thionyl chloride, and sulphuryl chloride, approximately in the proportions, $17SCl_2 + 2SOCl_2 + 5_2SOCl_2$. When it is distilled alone (under 50 mm. pressure), the first fraction of the distillate has not quite the same composition as the last. When it is distilled with sulphur, thionyl and sulphuryl chlorides distil over, and finally sulphur chloride, S_2Cl_2, which must have been formed by the action of the sulphur on the sulphur dichloride present. C. F. B.

Atomic Weight and Derivatives of Selenium. By VICTOR LENHER (*J. Amer. Chem. Soc.*, 1898, **20**, 555—579).—Two series of determinations of the atomic weight of selenium were made by analysing carefully purified silver selenite, Ag_2SeO_3, and ammonium selenibromide, $(NH_4)_2SeBr_6$. The silver employed in preparing the former was purified by Stas's method and converted into nitrate; the selenious anhydride was prepared from pure selenium by means of nitric acid, and was purified by repeated sublimation. On dissolving it in water and adding the purified silver nitrate, a white precipitate of silver selenite was obtained which crystallised from dilute nitric acid in anhydrous plates having a sp. gr. = 5·9297. The analyses were carried out by expelling the selenium completely in the form of dioxide, by passing hydrogen chloride over the salt contained in a porcelain boat, heated in a combustion tube; the residue of silver chloride was weighed, and was then reduced by purified hydrogen to metallic silver, and the latter weighed. The average of eleven experiments gives as the atomic weight of selenium, calculated from the silver chloride formed, the value 79·329 (O = 16), the probable error being ±0·009; exactly the same value was obtained from the weight of reduced silver in eight of these experiments. Attempts to obtain sodium selenite sufficiently pure to serve as a means of determining the atomic weight of selenium failed. Ammonium selenibromide, however, was readily prepared pure by dissolving ammonium bromide (9 parts) in water, adding selenium (4 parts) and a slight excess of bromine until a clear solution was obtained, and heating on the water-bath until the excess of bromine was expelled; on slow evaporation, crystals of ammonium selenibromide separated, which were purified by repeated crystallisation. Special care was taken to purify the materials used in preparing the salt. The latter was analysed by precipitating the selenium by hydroxylamine hydrochloride, according to Keller's method (Abstr., 1898, ii, 575), and the mean of eight experiments gave a value 79·285 (O = 16) for the atomic weight, with a probable error ±0·011. The general mean of all the author's experiments is 79·314.

Double Bromides of Selenium.—Although potassium and ammonium selenibromides are easily obtained by adding potassium or ammonium bromide to an aqueous solution of selenium tetrabromide (Muthmann and Schäfer, Abstr., 1893, ii, 318), the corresponding sodium and lithium salts do not appear to exist. The selenibromides of *rubidium*, Rb_2SeBr_6, and *cæsium*, Cs_2SeBr_6, are somewhat less soluble than the corresponding potassium salt, although closely resembling it in crystalline form; they are best prepared by adding a slight excess of bromine to a solution of the alkali bromide containing in suspension the theoretical amount of selenium, and evaporating on the water-bath until crystals separate. Corresponding organic salts containing selenium can be prepared by adding the hydrobromide of a base, dissolved in alcohol, to an alcoholic solution of selenium dioxide in concentrated hydrobromic acid. They are all decomposed by water, and prolonged digestion with ether extracts selenium tetrabromide. *Methylamine selenibromide*, $(NH_2Me)_2,H_2SeBr_6$, separates from alcohol containing hydrobromic acid in well defined red crystals; *ethylamine selenibromide*, $(NH_2Et)_2,H_2SeBr_6$, forms red, hexagonal prisms. The *dimethylamine* salt, $(NHMe_2)_2,H_2SeBr_6$, and the *trimethylamine* salt, $(NMe_3)_2,H_2SeBr_6$, separate from alcohol in red crystals, whilst *tetrethylammonium selenibromide*, $(NEt_4)_2SeBr_6$, forms flat, hexagonal plates. On adding the hydrobromides of aniline and diphenylamine to an aqueous solution of selenium tetrabromide, no double salt is formed, but the selenium is almost completely precipitated in the free state. Phenylhydrazine and quinoline act similarly; pyridine hydrobromide, however, gives rise to the *salt*, $(C_5H_5N)_2,H_2SeBr_6$, which crystallises from alcohol in deep-red leaflets or prisms, but is decomposed by other solvents. The *piperidine* salt, $(C_5H_{11}N)_2,H_2SeBr_6$, which crystallises from alcohol in red plates, closely resembles the pyridine derivative.

Existence of Selenium Monoxide (compare Pierce, Abstr., 1898, ii, 403).—In subliming large quantities of pure selenious anhydride, no odour similar to that attributed by Berzelius to selenium monoxide was noticeable. On heating a mixture of equivalent quantities of selenium and its dioxide, either in an open vessel, or in a sealed tube, to the boiling temperature of selenium, no interaction took place, and no gaseous product could be detected. Selenium monobromide does not act on dry silver oxide below 20°, but at this temperature a violent action takes place, selenious anhydride alone being formed. From these experiments, it is concluded that selenium monoxide does not exist (compare Chabrié, *Ann. Chim. Phys.*, 1890, [vi], **20**, 273).

W. A. D.

NOTE BY ABSTRACTOR.—Norris (Abstr., 1898, i, 510), has already described the salt, $(NHMe_2)_2,H_2SeBr_6$, prepared from dimethylamine, and in addition has obtained the salts, $3NHMe_2,HBr,SeBr,2SeBr_4$; $2(NHMe_2,HBr_2),SeBr_4$; $2(NHMe_2,HBr_2),SeBr_4$; and

$2(NHMe_2,HBr_2),NHMe_2,HBr,SeBr_4$.

Similar salts were also obtained from trimethylamine.

Copper Selenate. Preparation of Selenic Acid. By RENÉ METZNER (*Compt. rend.*, 1898, **127**, 54—57).—A solution of selenious acid was oxidised by a current of chlorine, the reaction being accompanied by the development of 30 Cal., and the solution of selenic acid thus obtained was neutralised with pure cupric oxide. On cooling the liquid, after concentration by evaporation, pale blue prisms of copper selenate, $CuSeO_4 + 5H_2O$, were deposited. Attempts were made to substitute bromine for chlorine in the preparation of the salt, but it was found that the oxidation of the selenious acid was never complete. The solubility of copper selenate varies greatly with the temperature; 1 litre of the saturated solution was found to contain 257 grams of the salt at 15°, 346 grams at 35°, and 435 grams at 55°. At about 70°, the solution undergoes decomposition, with formation of a green, crystalline deposit which is seen under the microscope to consist of small, monoclinic prisms. This compound was first obtained, but not analysed, by Mitscherlich; the author's analyses show that it has the composition $2CuSeO_4,CuO + 5H_2O$. When crystallised from a solution containing a large excess of selenic acid, copper selenate forms microscopic, transparent, tabular crystals of the composition $CuSeO_4 + 2H_2O$. The crystals lose water on exposure to a dry atmosphere, and when dried at 100° only one molecule of water is retained. The heat of formation of copper selenate (18·12 Cal.) was deduced from the heat developed (13·06 Cal.) on precipitating a normal solution of the salt with the equivalent amount of potash. The heat of dissolution is – 2·66 Cal.

Selenic acid was obtained in a very pure state by the electrolysis of a saturated solution of copper selenate with a current of 5 ampères at 2—3 volts. N. L.

Decomposition of Nitric Acid by Heat at Moderate Temperatures. By MARCELLIN P. E. BERTHELOT (*Compt. rend.*, 1898, **127**, 83—88).—Small quantities of pure nitric acid were introduced into tubes previously made vacuous and having a volume about 20 times that of the liquid, and the tubes were then kept in the dark at the ordinary temperature for several weeks; the nitric acid remained unaltered. When, however, similar tubes are heated at 100°, also in the dark, the nitric acid decomposes into nitric peroxide, oxygen, and water, and the decomposition at first increases with the time, but the rate of increase gradually falls. The decomposition is always incomplete and is limited chiefly by the water produced. Nitric acid of sp. gr. 1·333 undergoes practically no change at 100° under similar conditions.

The decomposition can scarcely be regarded as reversible, since the oxygen will combine very slowly with any nitrous acid that may be formed by the action of the nitric peroxide on the water. The decomposition of nitric acid into nitric peroxide, oxygen, and water at 100° would absorb about – 6·5 Cal. per molecule of acid. The decomposition of nitric anhydride absorbs much less, hence the instability of this compound. On the other hand, the heat of formation of hydrated nitric acid is much higher than that of the anhydrous acid, hence the greater stability of the former. C. H. B.

Action of Free Hydrogen on Nitric Acid. By MARCELLIN P. E. BERTHELOT (*Compt. rend.*, 1898, **127**, 27—29).—Sealed tubes containing known quantities of hydrogen and concentrated nitric acid were exposed to direct sunlight for two weeks, kept in the dark during the same period, and heated at 100° for 1 to 5 hours. In every case, the original volume of hydrogen employed was recovered on examining the contents of the tubes, even when the experimental conditions had been such that the nitric acid itself was decomposed, with liberation of oxygen. This inactivity of hydrogen towards nitric acid is in striking contrast with its behaviour with concentrated sulphuric acid, which is acted on at the ordinary temperature with formation of sulphurous acid.

The liberation of oxygen from pure nitric acid takes place at 100° and also, under the influence of light, in the cold; it does not take place in the dark at the ordinary temperature. The author's observations on this point will be published hereafter. N. L.

Action of Dilute Nitric, Sulphuric, Hydrochloric and Phosphoric Acids on Nitrates in the Presence of Ether. By CHARLES TANRET (*Bull. Soc. Chim.*, 1897, [iii], **17**, 497—503).—It has previously (Abstr., 1897, ii, 255) been shown that the presence of nitrates raises the coefficient partition of dilute nitric acid between ether and water. This property affords a basis for a method of extracting free nitric acid from solutions of nitrates by the aid of ether.

The reaction between dilute sulphuric acid and an excess of potassium nitrate is represented as follows: $H_2SO_4 + 2KNO_3 = HNO_3 + KNO_3 + KHSO_4$. If the nitric acid thus formed is removed by ether, then the acid sulphate tends to dissociate under the influence of the water into sulphuric acid and the normal sulphate. The sulphuric acid will then act on a further amount of potassium nitrate according to the above equation, until the whole of the sulphuric acid has been converted into normal sulphate, as if the reaction had taken place according to the equation $H_2SO_4 + 2KNO_3 = K_2SO_4 + 2HNO_3$. This has been proved experimentally by taking 20 c.c. of water containing 0·20 gram of sulphuric acid, dissolving in this 5 grams of potassium nitrate, and extracting with 200 c.c. of ether, the extraction being repeated six times.

Hydrochloric acid reacts in the same manner as sulphuric acid. Phosphoric acid reacts according to the equation $H_3PO_4 + KNO_3 = HNO_3 + KH_2PO_4$.

Nitric acid acting on normal sulphates gives acid sulphates; the acid sulphate does not sensibly dissociate, yielding free sulphuric acid. The action between nitric acid and chlorides is not appreciable.

J. J. S.

Homogeneity of Helium. By WILLIAM RAMSAY and MORRIS W. TRAVERS (*Proc. Roy. Soc.*, 1898, 52, 316—324).—The gas was separated into six fractions by diffusion through a piece of pipe stem. Fraction No. 1 was then pumped into the diffusion vessel, one half of it was diffused and transferred to vessel No 1; fraction No. 2 was then added, and one-third of the mixture diffused and transferred to vessel No. 1; fraction No. 3 was then added, and one half of the whole diffused and transferred to vessel No. 2; fraction No. 4 added and one half diffused and transferred to vessel No. 3, and so on. After four such complete fractionations in the case of air, the extreme fractions contained 17·37 and 22·03 per cent. of oxygen respectively. In the case of nitrogen, prepared from solutions of ammonium chloride and sodium nitrite, with some copper sulphate, thirty fractionations produced no alteration in density. Repeated fractionations of samples of helium from samarskite and cleveite resulted in the separation of helium with density 1·98 and refractivity 0·1238 as the lightest fraction, and a very little nearly pure argon as the heaviest fraction. The light fraction was apparently pure helium, as further diffusion did not alter its density. "It appears, therefore, that helium contains no unknown gas, nor is it possible to separate it by diffusion into any two kinds of gas; all that can be said is that most minerals which evolve helium also evolve argon in small quantity."

The authors had hoped to find an element with density = 10 and atomic weight = 20; they still regard the existence of such an element as probable, for it would form with He = 4 and A = 40 a triad like F = 19, Cl = 35·5, Mn = 55 and many similar triads occurring in the groups of the periodic table.

C. F. B.

Conversion of Potassium Iodide and Bromide into Potassium Chloride. By FRIEDRICH W. KÜSTER (*Zeit. anorg. Chem.*, 1898, **18**, 77—82).—Potassium iodide is easily and completely converted into potassium chloride by heating it in a porcelain crucible in a current of chlorine. Potassium bromide, on the other hand, cannot be completely converted into chloride by means of a current of dry chorine unless it is heated to such a high temperature that potassium chloride begins to volatilise. In the presence of water, however, the conversion into chloride is complete at moderate temperatures. The potassium bromide (2·49 grams) is treated in a small Erlenmeyer flask with 1 c.c. of water and a drop of hydrochloric acid and then heated in a brisk current of chlorine. The flask is placed on an asbestos plate with another asbestos plate 2 c.c. below the first and under this a small burner. After 1—1½ hours heating below the boiling point, the water is evaporated off and finally the asbestos plate on which the flask rests is heated to redness for a short time, and the operation repeated until a constant weight is obtained. E. C. R.

Specific Gravity of Sodium Chloride Solutions. By H. C. HAHN (*J. Amer. Chem. Soc.*, 1898, **20**, 621—630).—This is an elaborate investigation as to the best way of accurately determining the sp. gr. of sodium chloride solutions. To be of any real value, the sp. gr. at 15·08° should be exact to the fourth place of decimals. In this case, if S = the sp. gr., the percentage of sodium chloride will be $60,209,585 - 626,853,1S + 1067,352,667S^2 - 633,92S^3 + 133,333,333S^4$. A main factor in determining the sp. gr. is the knowledge of the sp. gr. of the air in the balance case, which depends on the pressure, temperature, moisture, and the amount of carbonic anhydride. For further particulars, the original paper should be consulted, the results being set forth in a very comprehensive table. L. DE K.

Action of Sodium Metarsenite on Metallic Salts. By C. REICHARD (*Ber.*, 1898, **31**, 2163—2171).—When sodium metarsenite, $Na_2As_2O_4$, was added to excess of a solution of a metallic salt, free

Composition.	Metallic salt used.	Properties.
$Ni_3As_2O_6$	$Ni(NO_3)_2$	Bright green, amorphous powder.
$Pb_3As_2O_6$	$Pb(NO_3)_2$	Heavy, white powder.
$Zn_3As_2O_6$	$ZnSO_4$	Crystallises from ammonia in white needles.
$Sn_3As_2O_6$	$SnCl_2$	Yellowish-white; decomposed by acids and alkalis with separation of metallic arsenic.
$Co_2As_2O_5$	$Co(NO_3)_2$	Amethyst-coloured mass.
$Cd_2As_2O_5$	$CdSO_4$	White substance.
$Cu_4As_2O_7$	$CuSO_4$	Green, amorphous powder.
$Fe_4As_2O_9$	$FeSO_4$	Greenish-white substance, turning rusty in the air.
$Mn_5As_2O_8$	$MnSO_4$	White, turning pink to brown in the air.
$Hg_5As_2O_8$	$HgCl_2$	White mass, turning yellow and decomposing in daylight.
$Sn_7As_2O_{17}$	$SnCl_4$	Yellowish-white mass.
$Ag_6As_4O_9$	$AgNO_3$	Yellowish substance, decomposed by caustic soda with separation of metallic silver.

acid was always liberated, and the precipitate was in 4 cases (enumerated first in the table) an orthoarsenite, in 2 (the next two) a pyroarsenite, but in no case was it a metarsenite. The substances prepared are described in the table (p. 23). C. F. B.

Action of Hydrogen on Silver Sulphide. By H. Pélabon (*Compt. rend.*, 1898, **126**, 1864—1866).—Hydrogen acts on silver sulphide in sealed tubes above 250°, the proportion of hydrogen sulphide formed at first increasing with the time but eventually becoming constant. Conversely, in a tube containing silver and hydrogen sulphide, the quantity of the latter gradually diminishes until it reaches a limit. At any given temperature above 350°, the limit is the same, whether the initial system contained hydrogen sulphide and silver, or silver sulphide and hydrogen. The ratio, ρ, of the partial pressure of the hydrogen sulphide to the total pressure of the mixture diminishes as the temperature rises and the curve that represents it as a function of the temperature approaches the axis of the abscissæ as the temperature increases. Between 360° and 700°, the curve is identical with a straight line passing through the points $\rho = 0{\cdot}21$, $t = 360°$, and $\rho = 0{\cdot}16$, $t = 700°$. Whatever the initial system, equilibrium is reached more quickly the higher the temperature; at 360°, about 160 hours is necessary, whilst at 580° a few moments suffice. At a given temperature, the limit value of ρ is independent of the physical condition of the silver or silver sulphide, and, moreover, is the same if the initial system consisted of silver, hydrogen, and sulphur. The silver liberated from the silver sulphide forms filiform masses only when the temperature is below 580°, and the best specimens are obtained by heating crystallised silver sulphide and hydrogen in sealed tubes at 440°. C. H. B.

Heat of Formation of Lithium Carbide. By Antoine Guntz (*Compt. rend.*, 1898, **126**, 1866—1868).—The action of water on lithium carbide, C_2Li_2, develops $+37{\cdot}10$ Cal., and hence C_2 (diamond) $+ Li_2$ sol. $= C_2Li_2$ (sol.) develops $+11{\cdot}3$ Cal., a value which is much higher than the corresponding values for sodium or calcium, and explains the formation of lithium carbide under such varied conditions. When the carbide is prepared by the direct action of lithium on carbon, the mixture must be placed in an iron dish in a hard glass tube enclosed in a glazed porcelain tube, and the tubes must be made vacuous, because lithium readily combines with nitrogen. The temperature must not exceed a dull red heat, otherwise the carbide dissociates. Even the diamond is attacked by lithium at this temperature. The carbide cannot be obtained by heating carbon with lithium carbonate, because the latter volatilises before it dissociates.

When the carbide is added to fused lithium chloride, lithium subchloride and carbon are formed, but at a high temperature the subchloride dissociates into the normal chloride and lithium, and the latter attacks the carbon, and these changes go on until a condition of equilibrium is established. These observations explain why a carbon cathode cannot be used for the isolation of lithium by electrolysis of the fused chloride. C. H. B.

Calcium Hydride. By HENRI MOISSAN (*Compt. rend.*, 1898, **127**, 29—34).—Calcium hydride is obtained by heating crystallised calcium (Abstr., 1898, ii, 578), contained in a nickel boat, to dull redness in an atmosphere of dry hydrogen. Comparison of the weight of metal employed with the weight of hydride obtained, and measurement of the volume of hydrogen evolved on treating the substance with water, show that the hydride has the composition CaH_2. Obtained as above, calcium hydride forms a white, fused mass of crystalline fracture, which is shown by microscopic examination to consist of slender, transparent plates; it has a sp. gr. = 1·7. When heated to 600° in a vacuum, no appreciable dissociation occurs; nor is the hydride affected by heating in hydrogen at the melting point of glass. It is decomposed by the halogens at a dull red heat, with incandescence. When heated to redness in air or oxygen, it burns brilliantly, and sufficient heat is evolved to cause fusion and crystallisation of the calcium oxide formed. Calcium hydride is decomposed by heating in sulphur or phosphorus vapour, but no action was observed with selenium at the melting point of glass, or with nitrogen, silicon, and boron. When heated at 700—800° with finely-divided carbon, calcium hydride is partially decomposed, with production of calcium carbide. Metallic fluorides, sodium chloride, and silver iodide are decomposed when heated with calcium hydride, but potassium iodide is not acted on. Chlorates, perchlorates, bromates, or permanganates, and similar oxidising agents, are reduced with explosive violence. Hydrogen sulphide, nitric oxide, and carbonic anhydride are also decomposed at a red heat. Calcium hydride is readily decomposed by water and by dilute acids; concentrated sulphuric and nitric acids, however, have but little action in the cold. Benzene, turpentine, and alkyl chlorides and iodides, when free from water, are without action on calcium hydride; ethylic alcohol slowly attacks it. The vapour of carbon tetrachloride is decomposed, with incandescence, at about 400°.

N. L.

Solubility of Lime in Water at Different Temperatures. By ALEXANDER HERZFELD (*Bied. Centr.*, 1898, **27**, 571; from *Oesterr. Zeits. Zuckerind.*, 1897, 1197).—The amounts of water required to dissolve 1 part of CaO at different temperatures are as follows.

15°	20°	25°	30°	35°	40°	45°	50°	55°	60°	65°	70°	75°	80°
776	813	848	885	924	962	1004	1044	1108	1158	1244	1330	1410	1482

N. H. J. M.

Solubility of Lime in Aqueous Solutions of Sodium and Potassium Chloride. By GODFREY L. CABOT (*J. Soc. Chem. Ind.*, 1897, **16**, 417—419).—Curves are given which show that the solubility of lime in solutions of either sodium or potassium chloride is a maximum for all temperatures when the solution contains about 60 grams of the salt per litre; it is a minimum at any fixed temperature when the solution is saturated, the solubility then being much less than in pure water of the same temperature. A solution of sodium chloride dissolves more lime at all temperatures and concentrations than a corresponding solution of potassium chloride. In all cases, the maximum solubility of lime in the chloride solution occurs when the temperature is lowest; with solutions of all concentrations, the solubility decreases regularly as the temperature increases.

W. A. D.

Formation and Composition of Bleaching Powder. By Hugo Ditz (*Chem. Zeit.*, 1898, **22**, 7—9).—The author regards the formation of bleaching powder as taking place in several stages. The first action of chlorine on the slaked lime is to give ($CaO,CaCl\cdot OCl + 2H_2O$); further action gives ($2CaCl\cdot OCl + CaO,CaCl\cdot OCl + 4H_2O$); yet further action, ($6CaCl\cdot OCl + CaO,CaCl\cdot OCl + 8H_2O$). In practice, the reaction seems to stop here; theoretically, it might continue indefinitely, yielding successive members of the series [$(2n - 2)CaCl\cdot OCl + CaO,CaCl\cdot OCl + 2nH_2O$]. Most bleaching powders consist of mixtures of the first three members, ($n = 0$, 1, 2), the formulæ of which are given above; but of the numerous published analyses of bleaching powders, some are found to correspond very well with these three; three such analyses are quoted below.

	$n=0$.		$n=1$.		$n=2$.	
	Found.	Calc.	Found.	Calc.	Found.	Calc.
Total CaO	52·12	51·14	44·12	44·01	41·27	41·14
Available Cl	31·44	32·42	41·05	41·85	44·5	45·64
CaO from CaO,CaCl·OCl...	27·33	25·57	11·80	11·00	5·40	5·14

It is shown that these views allow of a satisfactory explanation of the reactions of bleaching powder with carbonic anhydride, with sulphurous anhydride, and with acetic acid, and of its behaviour when heated. It is proposed to perform experiments with a view to testing their truth further.

C. F. B.

Decomposition of Barium and Calcium Dihydrogen Phosphates by Water at 100°. By Georges Viard (*Compt. rend.*, 1898, **127**, 178—180).—The monobasic phosphates of the alkaline earths are known to undergo partial decomposition by water at the ordinary temperature, with liberation of phosphoric acid and precipitation of a dibasic phosphate. The author has studied the decomposition of monobarium and monocalcium phosphates by water at 100°, and finds the reaction to be similar to that which occurs in the cold, the quantitative results, however, are different. As the weight of monobasic phosphate which is heated with a constant weight of water increases, the ratio of the total phosphoric acid remaining in solution to the combined phosphoric acid also increases, at first rapidly and then more slowly, until it becomes sensibly constant. The limiting value of this ratio was found to be 2·8 for the barium, and 2·34 for the calcium, salt; in the cold, the values obtained by Joly were 2·0 and 1·5 respectively. Analysis shows that the precipitate consists only of the dibasic phosphate, unless a saturated solution has been employed, in which case the precipitate is contaminated with undissolved monobasic phosphate. It is to be observed that the precipitated dicalcium phosphate is always anhydrous and insoluble in acetic acid, whereas, if the decomposition takes place in the cold, the hydrated phosphate, $Ca_2H_2(PO_4)_2 + 4H_2O$, is formed, which is soluble in acetic acid.

The composition of the precipitate being once determined, the ratio R, of the total to the combined phosphoric acid may be calculated from the weight of the precipitate. For, if P is the weight of monobasic phosphate employed, M its molecular weight, p the weight of dibasic phosphate precipitated, m its molecular weight, and q the molecular weight of phosphoric anhydride, then the weights of the latter contained in P and p are Pq/M and pq/m respectively and

$$R = \left(\frac{P}{M} - \frac{p}{m}\right) \div \left(\frac{P}{M} - 2\frac{p}{m}\right)$$

N. L.

Anhydrous Crystalline Magnesium Sulphide. By A. MOURLOT (*Compt. rend.*, 1898, **127**, 180—183).—Amorphous magnesium sulphide is best prepared by passing a current of hydrogen sulphide over a mixture of sulphur with magnesium filings contained in a carbon boat, which is placed in a porcelain tube heated in a reverberatory furnace. The sulphide is thus obtained as a white, or slightly grey, mass, which analysis shows to have the composition MgS. Another method of preparation consists in passing hydrogen sulphide over anhydrous magnesium sulphate or oxide heated to about 1200°; in this, however, the action is much slower.

When the amorphous sulphide is heated for a few minutes in the electric furnace, it is converted into a globular mass of crystalline fracture, which is shown by analysis to have the same composition as the amorphous sulphide; the crystalline sulphide may be also prepared by heating, in the electric furnace, a mixture of magnesium chloride with stannous sulphide in molecular proportion. Attempts to prepare it by the reduction of magnesium sulphate with carbon gave unsatisfactory results.

The crystalline magnesium sulphide obtained by the methods described above consists of a mass of cubical crystals of sp. gr. = 1·85, which have no action on polarised light, and exhibit two cleavage planes at right angles to each other. It is not acted on by hydrogen at the highest temperature of a reverberatory furnace, but is decomposed, with incandescence, by chlorine at about 300°, with the formation of the chlorides of magnesium and sulphur; bromine and iodine also decompose it at a dull red heat. The crystalline sulphide is readily oxidised when heated in oxygen, and also by heating with potassium chlorate, potassium nitrate, lead peroxide, and phosphoric anhydride. It is not reduced by heating at a high temperature with phosphorus, boron, silicon, or iron; sodium, however, decomposes it. It is readily acted on by steam, with formation of magnesium oxide and hydrogen sulphide; at the ordinary temperature, however, water acts with great difficulty on the crystalline sulphide, whereas the amorphous sulphide is immediately decomposed. Nitric and sulphuric acids and gaseous hydrogen fluoride and chloride act on the crystalline sulphide at the ordinary temperature, whilst hydrogen bromide and iodide react at a dull red heat. It is also readily attacked by phosphorus trichloride and by chromyl chloride; in the latter case, a greenish substance is produced, the nature of which is being investigated; it contains both chromium and sulphur.

N. L.

Formation of Metallic Sulphides by Mechanical Influences. By LÉON FRANCK (*Bull. Soc. Chim.*, 1897, [iii], **17**, 504—506).—Spring has shown that sulphides of magnesium, zinc, iron, copper, &c., may be obtained by subjecting intimate mixtures of the metals and sulphur to a pressure of 6500 atmospheres (Abstr., 1883, 904; 1884, 959), and it has long been known that mercuric sulphide may be obtained by triturating the metal with sulphur, cuprous sulphide by triturating the metal with sulphur under water, and ferrous sulphide in a similar manner with hot water. The author finds that when a mixture of flowers of sulphur and of magnesium powder is rubbed between two sheets of paper, hydrogen sulphide is evolved. A similar reaction occurs with aluminium powder and sulphur, or even when sheet aluminium is rubbed with flowers of sulphur. J. J. S.

Yttrium Earths in Monazite Sands. By G. URBAIN (*Compt. rend.*, 1898, **127**, 107—108).—Further investigations have confirmed the utility of the method of fractionating by means of ethyl-sulphates; it is especially valuable for resolving a complex mixture into groups to which the other methods of fractionation can be applied much more easily than to the original substance. The constituents of crude yttria do not separate with uniform distinctness; it is easy, for example, to obtain erbium quite free from holmium, but very difficult to eliminate erbium from the fractions rich in holmium. By combining the ethyl-sulphate method with some of the older methods, the author finds that the crude yttria from monazite sands consists chiefly of yttrium of atomic weight 89, and contains terbium with an atomic weight as high as 151·4, but no element with the atomic weight 100 or 97. C. H. B.

Metallic Phosphates. By ROBERT M. CAVEN and ALFRED HILL (*J. Soc. Chem. Ind.*, 1897, **16**, 29—30. Compare Abstr., 1898, ii, 591).—On adding disodium hydrogen phosphate to an aqueous solution of aluminium sulphate, no precipitate is formed at first, but on boiling for an hour, the greater part of the aluminium is precipitated as phosphate. An excess of ammonium chloride partially precipitates aluminium phosphate from a solution of the latter in aqueous ammonia or caustic alkalis. Cold, dilute acetic acid dissolves aluminium phosphate, but, on boiling, the latter is precipitated; ammonium acetate does not produce a precipitate with the cold solution, nor with a solution of the phosphate in hydrochloric acid to which an excess of acetic acid has been added; if, however, only a small quantity of acetic acid is present in the latter case, ammonium acetate gives rise to a precipitate of aluminium phosphate. On adding dilute acetic acid and ammonium acetate to a nearly saturated solution of aluminium phosphate in aqueous aluminium sulphate, a precipitate is produced, although none is formed when only a small amount of the phosphate is present; in the latter case, the addition of a little disodium hydrogen phosphate brings about precipitation.

Chromium phosphate is gradually precipitated on boiling a solution containing disodium hydrogen phosphate and chromium sulphate; it is not as easily soluble in aqueous ammonia as aluminium sulphate, but resembles the latter in being precipitated by ammonium chloride from its solution in caustic potash. Chromium phosphate is readily soluble in acetic acid, but is precipitated from neutral solutions by ammonium acetate; like ferric phosphate, it undergoes hydrolysis when washed with water.

Traces of chromium and aluminium may be detected in presence of large quantities of ferric phosphate by fusing the mixed phosphates with potassium hydroxide on platinum foil; on adding ammonium chloride to the aqueous extract, aluminium is precipitated as mixed phosphate and hydroxide, and, on filtering, a yellow solution is obtained if chromium is present, becoming green when sulphurous acid is added.

Cupric phosphate is somewhat soluble in aqueous cupric chloride and cupric sulphate, and undergoes hydrolysis when washed with water; on boiling with water, it is converted into a basic phosphate, $Cu_3(PO_4)_2,CuO,H_2O$, as stated by Steinscheider (Abstr., 1891, 1423), whilst aqueous potash completely hydrolyses it to cupric oxide.

Bismuth phosphate is somewhat soluble in aqueous bismuth chloride, but is not hydrolysed by boiling water, although completely converted into oxide when boiled with caustic alkalis.

Lead phosphate is insoluble in aqueous lead nitrate, and is not changed when boiled with water; it easily dissolves in boiling caustic potash, but less readily in aqueous ammonia. W. A. D.

Influence of Silicon on the Heat of Solution of Coke Cast Irons. By EDWARD D. CAMPBELL and WILLIAM E. HARTMAN (*J. Amer. Chem. Soc.* 1898, **20**, 690—695).—The object of this research was to determine if any thermochemical evidence could be obtained of a change in the condition in which silicon exists in cast iron, this change being due to differences of the temperature at which the iron is made. The solvent was a solution of ammonium copper chloride in the molecular ratio $(NH_4Cl)_2CuCl_2 : 50H_2O$, but with the addition of 0·84 per cent. of free hydrochloric acid. When either from a sufficiently high temperature of the blast furnace at the time the iron is made, or from the presence of a moderate amount of silicon, probably about one and four-tenths per cent., the carbon is nearly all in the graphitic or "graphitic temper" form; then the heat evolved by the oxidation of the silicon, is proportional to the amount of silicon present. When from a low temperature in the furnace accompanied by low silicon, the carbon is largely in the combined form, then the heat rendered sensible is very much diminished owing to the large amount of heat necessary to decompose the compounds of iron and carbon, or possibly compounds of iron, silicon, and carbon, or of carbon and silicon. As the oxidation of one gram of silicon alone develops 3824 Cal., and the results obtained by dissolving cast irons give a maximum of 3303 Cal., it is evident that the compound of silicon with iron must have a very considerable heat of formation. When the percentage of silicon is nearly sufficient to correspond with the empirical formula $SiFe_3$, the compound is insoluble in ammonium copper chloride. H. C.

Constitution and Genesis of Iron Sulphates. By RUDOLF SCHARIZER (*Zeit. Kryst. Min.*, 1898, **30**, 209—231).—In an investigation dealing with the genesis of native iron sulphates, the author has made experiments requiring several years for their completion. In this first paper are given the results of experiments on the loss of water, and oxidation of ferrous sulphate.

Over sulphuric acid, ferrous sulphate ($FeSO_4 + 7H_2O$) readily loses three molecules of water, $3H_2O$ more are given off, with partial oxidation of the ferrous sulphate, at 60—80°, $\frac{1}{2}H_2O$ is lost at 100—300°, whilst the remainder is only given off on ignition. When exposed to air, it effloresces after a long period of time to the end product $FeSO_4 + H_2O$. The products of oxidation of a ferrous sulphate solution depend on the lapse of time and on the degree of dilution of the solution; ferric sulphate is also formed [$10FeSO_4 + 5O = Fe_4SO_9 + 3Fe_2(SO_4)_3$], and this by its decomposition [$3Fe_2(SO_4)_3 + 8H_2O = Fe_6SO_{12} + 8H_2SO_4$] introduces further complications. One gram of ferrous sulphate in 50 c.c. of water gives a permanent ferric sulphate solution; in more concentrated solutions, soluble basic salts are formed, whilst in more dilute solutions there is free sulphuric acid.

L. J. S.

Decomposition of Water by Chromous Salts, and their Use for the Absorption of Oxygen. By MARCELLIN P. E. BERTHELOT (*Compt. rend.*, 1898, **127**, 24—27).—Since the oxidation of chromous chloride, with production of the oxychloride, Cr_2Cl_4O, is accompanied by the evolution of a larger amount of heat (100·4 Cal.) than is produced in the formation of water from its elements, there should be a tendency to the decomposition of water by chromous chloride. The latter reaction does not take place at the ordinary temperature in the case of pure solutions of chromous salts containing no free acid; above 250°, however, or at the ordinary temperature in presence of traces of free hydrochloric acid, decomposition slowly occurs, and hydrogen is evolved. An explanation of the influence of the hydrochloric acid in this reaction is suggested by a consideration of the properties of the green and violet modifications of chromic chloride, which are formed from chromous chloride with the evolution of 94·6 Cal. and 113·4 Cal. respectively. The oxychloride formed by the oxidation of the chromous chloride is not converted by the hydrochloric acid into the green chromic chloride, since this reaction would involve the absorption of 5·8 Cal.; under the influence of time, however, the formation of the violet modification is rendered possible, with the evolution of 13 Cal., and it is the supplementary energy of this reaction which determines the slow decomposition of the water.

It follows from the foregoing observations that an acid solution of chromous chloride should not be employed as an absorbent of oxygen in the exact analysis of gaseous mixtures, or in the purification of any gas but hydrogen. N. L.

Peroxides. By PETR. G. MELIKOFF and L. PISSARJEWSKY (*Zeit. anorg. Chem.*, 1898, **18**, 59—65).—The authors discuss the results which they have obtained in their researches on the peroxides (Abstr., 1898, ii, 161, 165, 219, 292, 332, 337, and 374). They have shown that the acid peroxides are capable of forming salts with alkali peroxides. The soluble salts, for example, the sodium and lithium salts of peruranic acid, when treated with aluminium hydroxide, are converted into the free acid and hydrogen peroxide; the insoluble salts, for example, the barium salt of peruranic acid, when treated with carbonic anhydride, behave like barium peroxide, and barium carbonate, hydrogen peroxide, and peruranic acid are formed.

Acid peroxides of the type RO_4 have been obtained from elements belonging to six groups. The stability of the salts which they form with alkali peroxides decreases with the atomic weight of the element which forms the acid peroxide. Those peroxides which are strong acids do not form salts with metallic peroxides, but decompose the latter, with formation of hydrogen peroxide.

The authors assign to the peroxy-acids and metallic peroxides a constitution of the type of hydrogen peroxide, HO–OH, since they show a similar behaviour towards many reagents. When treated with dilute sulphuric acid, they yield hydrogen peroxide; with concentrated sulphuric acid, many of them yield ozone. The peroxy-acids are decomposed by water in a similar manner to the metallic peroxides; thus, sodium perborate is partially [decomposed into sodium metaborate and hydrogen peroxide; they also behave in a manner similar to the metallic peroxides when treated with manganese peroxide, whereby oxygen is rapidly evolved in the case of soluble salts, and slowly in that of insoluble salts. The peroxy-acids very easily oxidise alkalis, converting them into peroxides, for example, in the case of peruranic acid according to the equation

$$3UO_4 + 4KOH = 2UO_3 + (K_2O_2)_2UO_4 + 2H_2O.$$

E. C. R.

Permolybdates. By Petr. G. Melikoff and L. Pissarjewsky (*Ber.*, 1898, **31**, 2448—2451).—The failure of Muthmann and Nagel (Abstr., 1898, ii, 593) to obtain potassium peroxide permolybdate having the properties described by the authors can only be due to their failure to reproduce the necessary experimental conditions, and for this reason the authors repeat their description of the method employed by them.

To a solution of potassium permolybdate prepared by Péchard's method (Abstr., 1891, 988) are added aqueous solutions of potash and hydrogen peroxide (3 per cent.) in amounts corresponding with the scheme $KMoO_4 + 3KOH + 4H_2O_2$; the liquid, which has now become dark red, is mixed with alcohol cooled to $-10°$ to $-12°$, insufficient in amount to precipitate potassium peroxide. The flocculent, red precipitate thus produced is separated by means of a filter cooled by ice and salt, washed with alcohol and ether successively, and finally dried on a cooled tile. The salt thus obtained is ready for analysis, and always possesses the same properties; it evolves oxygen when dissolved in water at the ordinary temperature, changing colour simultaneously, and it is exploded by friction, or by the heat spontaneously developed on exposure to air; it is not hygroscopic as was the substance obtained by Muthmann and Nagel, and it is probable that these experimenters were dealing with an impure specimen containing potassium peroxide.

The suggestion made by Muthmann and Nagel, that the foregoing substance contained some hydrogen peroxide, is untenable, as its properties are not sensibly different if excess of hydrogen peroxide be employed in its preparation, and when it is reprecipitated from a solution in alkaline hydrogen peroxide its properties remain unaltered. It is, therefore, a chemical individual.

The authors are unable to accept the view that the molybdates can combine with a molecular proportion of oxygen at low temperatures, and believe that there is much evidence to show that the "per-" acids form salt-like compounds with the metallic peroxides. A. L.

Action of Hydrogen on Potassium Paratungstate. By L. A. HALLOPEAU (*Compt. rend.*, 1898, **127**, 57—58).—When potassium paratungstate is heated to dull redness in a current of hydrogen, a mixture of tungsten dioxide with the blue oxide of tungsten is obtained. At higher temperatures, a compound of the composition K_2O,WO_3+WO_2,WO_3 is also produced, which crystallises in small, reddish-violet prisms having a coppery lustre. This substance, which appears to be identical with the compounds obtained by Laurent and by Wöhler, may be purified by prolonged washing with boiling water, concentrated hydrochloric acid, and potassium carbonate solution. At a bright red heat, it undergoes further reduction by hydrogen, with formation of metallic tungsten. N. L.

Production of Tungsten Blue by the Reduction of Tungsten in Porcelain Furnaces. By ALBERT GRANGER (*Compt. rend.*, 1898, **127**, 106—107).—When a mixture of barium and sodium tetratungstates, M'_2O,WO_3, is used as a glaze on porcelain and is heated in a reducing flame at about 1250°, it yields a blue colour varying from pale blue to indigo. The tint depends on the proportion of the two salts and the quantity of the glaze used, and can also be modified by adding borax or phosphates. The blue colour is most probably due to the formation of the oxide W_2O_5 in the conditions specified.

C. H. B.

Lead-antimony, Tin-antimony, Tin-arsenic, and Tin-phosphorus Alloys. By JOHN E. STEAD (*J. Soc. Chem., Ind.*, 1897, **16**, 200—208 and 309).—When alloys of lead and antimony containing from 1—12·66 per cent. of the latter, are melted and allowed to solidify, a perfectly homogeneous product is obtained. On increasing the proportion of antimony, however, crystals of the latter separate in a nearly pure state, and rising to the surface of the cooled product form a layer of a much lighter colour than the subjacent portion. The latter has a composition corresponding with the formula Pb_4Sb, and appears to be the eutectic alloy of the two metals; it has a sp. gr. = 10·48, melts at about 247°, and solidifies in ill-defined hexagonal plates. Although all lead-antimony alloys, except the eutectic, have two critical points, one of these always corresponds with the fusing temperature of the compound Pb_4Sb.

When alloys of tin and antimony are melted and cooled, as long as the amount of the latter does not exceed 7·5 per cent., perfectly homogeneous products are obtained. On increasing the amount of antimony, well-defined crystals separate, which consist of a combination of cubic and octahedral forms. They were isolated from the matrix by dissolving the latter completely in dilute nitric acid (sp. gr. = 1·04); thus obtained, they appear to consist of *tin antimonide*, SnSb, and have a sp. gr. = 6·96 (calc. 7·00). It appears that tin antimonide only crystallises from alloys containing an excess of tin; the crystals are formed best when 75 per cent. of the latter is present. On melting tin antimonide and allowing the mass to cool, cubic crystals are no longer formed in the solidifying mass; it appears that, like iron carbide, Fe_3C, tin antimonide is decomposed by fusion.

On melting alloys of tin and phosphorus containing from 0·04—5 per cent. of the latter, brilliant, white, crystalline plates of *tin phosphide*, Sn_3P_2, separate on cooling; this was isolated by the same process as was used for preparing tin antimonide. It is decomposed when heated in a stream of hydrogen, phosphine being formed, whilst spontaneously inflammable hydrogen phosphide is evolved when any of the tin-phosphorus alloys are acted on by concentrated hydrochloric acid.

A crystalline *tin arsenide* was isolated by the author from alloys of arsenic and tin; it separates from the still molten tin at a temperature of 530°, and apparently has the composition Sn_3As_2. W. A. D.

Oxidation of Aluminium in Contact with Mercury. By H. F. Hunt and L. J. Steele (*J. Soc. Chem. Ind.*, 1896, **15**, 849—850).—When aluminium is allowed to stand on mercury covered with a thick film of oxide, although apparently no amalgamation takes place, the aluminium is rapidly converted into its hydroxide. The action is not so rapid when the metal is kept beneath dirty mercury, and is very slight when aluminium is floated on freshly distilled mercury. The hydroxide is formed most rapidly on aluminium which has had its surface amalgamated by the ordinary methods. W. A. D.

A Chloriodide of Tin. By C. Lenormand (*J. Pharm.*, 1898, [vi], **8**, 249—253).—Although iodine does not act on anhydrous stannous chloride at the ordinary temperature, it combines with it, when heated at 100° for several hours, forming *tin chloriodide*, $SnCl_2I_2$. This is a mobile, red liquid, which fumes in the air, and has a sp. gr. = 3·287 at 15°; it is decomposed by water, and when poured into ether or ethylic, propylic, butylic, or amylic alcohol, gives rise to a crystalline *compound*. When tin chloriodide (100 grams) is heated, it begins to distil at 191°, but the temperature gradually rises to 297°; the residue (55·44 grams) in the flask at this temperature consists of nearly pure *stannic iodide*, SnI_4. If the distillate obtained be redistilled, a further quantity of stannic iodide is left, and still more can be isolated by repeating the process. Ultimately, 67·78 per cent. of stannic iodide and 26·82 per cent. of stannic chloride were obtained; the *total* result of the decomposition can therefore be expressed by the equation $2SnCl_2I_2 = SnCl_4 + SnI_4$. W. A. D.

Double Sulphates of Antimony and the Alkali Metals. By August Gutmann (*Arch. Pharm.*, 1898, **236**, 477—479).—*Antimony potassium sulphate*, $KSb(SO_4)_2$, prepared by dissolving antimonious oxide in a boiling solution of potassium sulphate in concentrated hydrochloric acid, crystallises in small, six-sided, nacreous leaflets. The corresponding *sodium* salt forms small, scaly crystals, and the *ammonium* salt large, glistening leaflets. A. W. C.

Action of Heat on the Double Rhodium-Alkali Nitrites. By ALEXANDRE JOLY and EMILE LEIDIÉ (*Compt. rend.*, 1898, **27**, 103—106). —The double nitrites of rhodium with potassium, sodium, and barium begin to decompose at about 360°, but the products at this temperature are complex and indefinite. If, however, the salts are heated in a vacuum between 440° and incipient redness until evolution of gas ceases, and the products are then treated with water, definite, insoluble, crystalline compounds are obtained. The potassium salt yields the compound $K_2O,6RhO_2$, the sodium salt the compound $Na_2O,8RhO_2$, and the barium salt the compound $BaO,12RhO_2$. These compounds are to be regarded as the salts of hexarhodous acid, octarhodous acid and dodecarhodous acid respectively, and the acids are products of the condensation of rhodous acid, H_2O,RhO_2. The existence of these compounds affords definite evidence of the existence of an oxide, RhO_2, with an acidic function; they are analogous to the chromites, cobaltites and manganites obtained by G. Rousseau, and their formation seems to show that the production of salts of peroxides by the action of heat on double nitrites is a property common to many of the metals of the platinum group. C. H. B.

Mineralogical Chemistry.

Cedarite, an Amber-like Resin from Canada. By RICHARD KLEBS (*Jahrb. f. Min.*, 1898, ii, 212; from *Jahrb. k. preuss. geol. Landesanst.*, for 1896, 1—32).—This resin, to which the new name cedarite is given, has been known since 1890 at Cedar Lake, near the mouth of the North Saskatchewan River, and in many other parts of Western Canada. It occurs as isolated grains in wood-bearing, alluvial beds, and appears to have been originally derived from strata of Cretaceous or Tertiary age. The grains, having sometimes the form of drops, are rarely as large as a pea, and never exceed a walnut in size. The resin is clear yellow, but sometimes brown and cloudy. The sp. gr. is that of amber, but the hardness rather less. Analysis gave

C.	H.	S.	O.	Ash.	Total.
78·15	9·89	0·31	11·20	0·45	100·00

It is only partially soluble in alcohol, ether, acetone, &c. Melting point 340°; at 390° it decomposes and leaves a residue of 86·8 per cent. of colophony. Succinic acid is absent. It is of much less commercial use than Baltic amber. Other fossil resins are compared with the one here described. [This mineral (formerly called chemawinite) has already been described, Abstr., 1892, 573]. L. J. S.

Uintahite (Gilsonite) Deposits of Utah. By George H. Eldridge (*Jahrb. f. Min.*, 1898, ii. Ref. 211; from 17th *Ann. Rept. U.S. Geol. Survey*, 1896, part i, 909—949).—Uintahite or gilsonite is an asphalt, occurring abundantly in the Uintah mountains of Utah. It differs from albertite and grahamite in the brown or reddish-brown streak, hardness of 2—2½, and sp. gr. of 1·065—1·070. It fills fissures, 1 in. to 18 ft. across, in the Tertiary beds, and has apparently been forced up from below. Analysis by W. C. Day (*J. Franklin Inst.*, 1895, **140**, No. 837) gave,

C.	H.	S.	O + N.	Ash.	Total.	Volatile.	Solid residue.
88·30	9·96	1·32	[0·32]	0·10	100·00	54·46	43·43

Day considers it to be a mixture of hydrocarbons of the paraffin, and perhaps also of the naphthalene, series. L. J. S.

Occurrence of Hydrogen Sulphide in the Natural Gas of Point Abino, Canada; Estimation of Sulphur in Gas Mixtures. By Francis C. Phillips (*J. Amer. Chem. Soc.*, 1898, **20**, 696—705).—The gas escaping from the well at Point Abino is strongly contaminated with hydrogen sulphide, which may be proved by passing it through solutions of lead acetate or ammoniacal cadmium chloride. The gas, after being passed through lead acetate, gives no precipitate or marked odour when again passed through mercuric chloride, showing the absence of volatile sulphur compounds; palladium chloride also remains unaffected.

In order to estimate the quantity of hydrogen sulphide, the lead sulphide obtained from a definite volume of the gas was oxidised by means of hydrochloric acid and potassium chlorate, and the sulphuric acid formed estimated as barium sulphide. A more convenient way, although requiring a complicated apparatus, was found to be to pass a current of carbonic oxide through a definite volume of the gas, and then to burn the mixed gas in oxygen, the products of combustion being collected in an absorption apparatus containing sodium carbonate and some bromine. All the sulphur was thus obtained as sulphuric acid, which was then estimated in the usual way, as barium sulphate. L. de K.

Composition of Retzian. By Hjalmar Sjögren (*Jahrb. f. Min.*, 1898, ii, Ref. 209; from *Geol. För. Förh.*, 1897, **19**, 106—112).—In the analysis of the new mineral retzian, a hydrated arsenate of manganese, calcium, &c., a constituent amounting to 10·3 per cent. (0·0082 gram) was previously not identified (Abstr., 1896, ii, 35). This is now stated to be rare earths, most probably yttrium oxides with a molecular weight of about 250. The manganese and calcium, as given in the analysis, may also have contained rare earths. A formula cannot yet be given. The orthorhombic crystals have the parameters, $a:b:c: = 0·4414:1:0·7270$. L. J. S.

Fergusonite, an Endothermic Mineral. By William Ramsay and Morris W. Travers (*Proc. Roy. Soc.*, 1898, **62**, 325—329).—The mineral examined gave, on analysis (by Miss Aston),

$(Nb,Ta)_2O_5$.	$(Y,Er, \&c.)_2O_3$.	$(Ce, \&c.)O_2$.	VO_2.	UO_3.	TiO_2.	SiO_2.	Fe_2O_3.	PbO.	CuO.	Total.
40·95	31·09	13·87	3·36	3·81	4·56	1·42	1·55	0·16	0·12	100·89

When heated to 500—600°, the mineral suddenly becomes incandescent, and liberates, per gram of mineral, He, 1·080 c.c.; H_2, 0·078; CO_2, 0·245; N_2, 0·027; on further heating with potassium hydrogen sulphate, it yields, in addition to CO_2, He, 0·733; N_2, 0·088; O_2, 0·394 c.c. per gram of mineral. The total percentage of helium is 0·0326. The density is 5·619 before, 5·375 after, heating to incandescence; the mean specific heat of the mineral between 0° and 17·3° is 0·1069. To determine the heat of decomposition, the mineral was heated in a platinum crucible (contained in a calorimeter) by burning under the crucible, in oxygen, a known weight of hydrogen, and noting the additional rise of temperature above that obtained when hydrogen was burned under the empty crucible. The heat of decomposition is +809 calories per gram of mineral, and is probably caused by the decomposition of an endothermic compound of helium with some constituent of the mineral. C. F. B.

Thaumasite from Skottvång, Sweden. By HELGE BÄCKSTRÖM (*Jahrb. f. Min.*, 1898, ii, Ref. 196; from *Geol. För. Förh.*, 1897, **19**, 307—310).—Thaumasite has recently been found at a new Swedish locality, namely, in the mines of Skottvång, parish of Gåsinge, Nyköping. It occurs as an aggregate of prismatic crystals between, and later than, crystal aggregates of apophyllite. The hexagonal prisms, are without distinct terminal faces, which are optically uniaxial and negative; $\omega = 1·505$, $\epsilon = 1·468$. Sp. gr. 1·871—1·875. Analysis gave,

H_2O.	CO_2.	SiO_2.	SO_3.	CaO.	Total.
43·28	7·01	9·68	12·88	27·16	100·01

This agrees closely with the usual formula,

$CaSiO_3,CaCO_3,CaSO_4,15H_2O$. L. J. S.

Diopside (Salite) as a Weathering Product in Palæopicrite from Medenbach (Nassau). By REINHARD BRAUNS (*Jahrb. f. Min.*, 1898, ii, 79—88).—With a little serpentine and calcite, salite fills crevices in a palæopicrite at Medenbach, near Herborn; it is compact to fibrous, and light grey to yellowish-grey. The optical characters are those of diopside, with the extinction angle $\mathfrak{c} : c = 40°$. Sp. gr. = 3·31. The following analysis by Noack gives the formula $Ca(Mg,Fe)Si_2O_6$.

SiO_2.	FeO.	MnO.	Al_2O_3.	CaO.	MgO.	Total.
55·56	3·65	trace	—	24·51	15·58	99·30

The palæopicrite is composed of olivine (mostly altered to serpentine), augite and plagioclase, with ilmenite and magnetite. In the serpentine are small, radiated groups of spear-shaped crystals of salite, which has been derived from the olivine. L. J. S.

Kainosite from the Ko Mine, Sweden. By HJALMAR SJÖGREN (*Jahrb. f. Min.*, 1898, ii, Ref. 202; from *Geol. För. Förh.*, 1897, **19**, 54—60).—Only one Norwegian crystal of this mineral, kainosite or cenosite, has previously been known. It has now been found in small, isolated crystals associated with clinochlore and apatite in a druse consisting mainly of magnetite and diopside at the Ko mine, Nordmark. The crystals, which do not exceed 2 mm. across, are yellowish-brown or dark chestnut-brown; they are opaque and have a feeble vitreous to greasy lustre, H = 5—6; there is no distinct cleavage. The short, prismatic crystals are orthorhombic, with the forms {110}, {001}, and {011}, and others less prominent. The parameters, $a:b:c = 0{\cdot}9517:1:0{\cdot}8832$, are compared with those of cerite. The mineral is easily soluble in hydrochloric acid with evolution of gas (CO_2?). Analysis by R. Mauzelius, on 0·0666 gram, gave

SiO_2.	Y_2O_3.	Fe_2O_3.	CaO.	MgO.	Alkalis.	H_2O.	CO_2.	Total.	Sp. gr.
31·7	35·9	2·9	16·5	1·4	3·6	2·9	[5·1]	100·0	3·38

With the Fe_2O_3 is possibly some BeO, and other elements may be present. This composition agrees with that of the Hitterö mineral.

Yttrium minerals usually occur in pegmatite veins and in other separations from ancient eruptive rocks; and an occurrence in an ore deposit is remarkable. L. J. S.

Minerals [Hessonite, &c.] from the Urals. By Aleksandr N. von Karnojitsky (*Zeit. Kryst. Min.*, 1898, **30**, 311—319; from *Verh. k. russ. min. Ges.*, 1896, [ii], **34**, 1—160).—The new Eugenie-Maximilianow mines, 15—20 km. west and north-west of Ekaterinburg, yield the following minerals, many of them as fine crystals: garnet (hessonite, &c.), epidote (very abundant), sphene, axinite, clinochlore, microcline, idocrase, beryl, corundum, &c. These are, in nearly all cases, confined to the junction of the orthoclase rocks (granite and syenite), and the amphibole rocks (gneiss, &c.), but they also rarely occur in dolomite at the dolomite-granite contacts. The following analyses are given of hessonite. I. Fine, transparent rhombic-dodecahedral crystals, often 3—4 cm. across, light yellow to dark-reddish in colour, from Mt. Pup. II. Transparent yellowish to orange-red crystals from Mt. Mjedwjeschka. III. Greyish-yellow crystals from the same locality. Analyses I, II by W. Alexéeff, III by W. Worobióff.

	SiO_2.	TiO_2.	Al_2O_3.	Fe_2O_3.	CaO.	MnO.	MgO.
I.	39·10	0·50	17·75	6·50	35·77	trace	0·19
II.	38·10	0·78	16·30	10·53	35·00	trace	trace
III.	39·3	0·4	17·9	6·3	35·5		1·3

All the crystals of hessonite show optical anomalies, the lighter coloured being the most strongly birefringent, whilst the darker are sometimes almost isotropic. The difference in colour, depending on the amount of iron, is also connected with a difference in optical orientation. L. J. S.

[Mariposite.] By Henry W. Turner (*Jahrb. f. Min.*, 1898, ii, Ref. 200; from 17th *Ann. Rept. U.S. Geol. Survey*, 1896, part i, 678—679; and *Amer. J. Sci.*, 1895, **49**, 377).—Mariposite was described by Silliman in 1868 as a green, micaceous mineral from the gold-quartz veins of Tuolumne and Mariposa counties, California. It is abundant at the Josephine mine, near Beau Valley. Analyses by Hillebrand gave I for the green, sp. gr. = 2·817; and II for the white, sp. gr. = 2·787. Water is not given off below 300°. In thin sections, both are nearly colourless: they show bright polarisation colours, and give straight, or nearly straight, extinction.

	SiO_2.	TiO_2.	Al_2O_3.	Cr_2O_3.	Fe_2O_3.	FeO.	CaO.	MgO.	K_2O.	$(Li,Na)_2O$.	H_2O.
I.	55·35	0·18	25·62	0·18	0·63	0·92	0·07	3·25	9·29	0·12	4·52
II.	56·79		25·29	Nil	1·59		0·07	3·29	8·92	0·17	4·72

No definite formula can be given, and the material appears to be similar to pinite.

L. J. S.

Marekanite-obsidian from Nicaragua. By JOHANNES PETERSEN (*Jahrb. f. Min.*, 1898, ii, 156—159).—Marekanite balls from Corinto in Nicaragua are described; they are about the size of hazel-nuts, and black, with vitreous lustre. They are difficult to break with a hammer, but when cut they fly to pieces; in form, they are approximately spheres or truncated pyramids, and the surfaces show concave areas. Under the microscope, fragments of the transparent, colourless glass show flow structure marked out by numerous globulites, trichites, and small crystals. These marekanite balls appear to be perlite balls rather than the kernels of perlites, as has been supposed, and a rock composed of them may be called a marekanite-obsidian. As shown by the following analysis, the composition is that of a liparite magma.

SiO_2.	Al_2O_3.	FeO.	MnO.	MgO.	CaO.	K_2O.	Na_2O.	H_2O.	Total.
76·68	14·49	1·09	trace	0·84	1·53	1·20	3·92	0·36	100·11

L. J. S.

Dyke Rocks from Adamello Mountains. By ÇARLO RIVA (*Jahrb. f. Min.*, 1898, ii, Ref. 247; from *Atti Soc. Ital. Sci. Nat.*, 1897, **27**, 265).—Numerous dyke rocks, mostly intersecting the tonalite, have recently been found in the Adamello Mountains, on the Italian-Tyrol border; they include diorite-porphyrites, vintlites, malchites, odinites, and aplites. Analysis I is of malchite, with hornblende and biotite, from the Passo di Campo; II, of malchite, with augite and biotite, from Lago d'Arno. Both are grey to grey-brown rocks with felspar (andesine-labradorite) and quartz. They are more basic than the surrounding tonalite.

	SiO_2.	Al_2O_3.	Fe_2O_3.	MgO.	CaO.	Na_2O.	K_2O.	H_2O.	Total.
I.	57·48	16·82	8·49	4·64	5·45	2·63	4·57	0·25	100·33
II.	56·77	20·02	6·40	3·70	5·40	4·01	3·94	0·13	100·36

L. J. S.

Analysis of the Mineral Water of Castrocaro. By FAUSTO SESTINI and R. CAMPANI (*L'Orosi*, 1897, **20**, 43—47).—The results of the analysis of this mineral water are given below in tabular form. The sp. gr. = 1·0312 at 15°. The total volume of the gases expelled from one litre by boiling is 50·15 c.c., including CO_2, 29·94 c.c.; O_2, 4·39 c.c.; N_2 (gas unabsorbed by potash or phosphorus), 15·80 c.c.

Substance.	Grams per litre.	Substance.	Grams per litre.
Cl	36·8109	Na_2O	28·0284
Br.	0·1382	CaO	2·2047
I	0·1516	MgO	1·2676
SO_3	0·5845	Fe_2O_3	0·0014
SiO_2	0·0219	Organic matter	0·6842
P_2O_5	0·0026		

Total solid residue dried at 180° = 61·7475. A series of monthly analyses made during the year 1891—1892 show that the composition of the water is fairly constant; there is, however, a marked decrease in the amounts of bromine and iodine, more especially the former, in the rainy months of the year. N. L.

The Sulphur Water of Sandefjord. By EYVIND BÖDTKER (*Annalen*, 1898, **302**, 43—51. Compare Strecker, *Annalen*, 1855, **95**, 177).—The Sandefjord is in the neighbourhood of Christiania, and opens into the Skager Rack. Water drawn from the spring there is a transparent, yellowish liquid having a powerful odour of hydrogen sulphide; owing to separation of sulphur, it becomes turbid on exposure to the air, but clear again after a long interval. The liquid is neutral, but acquires alkaline properties if kept in glass bottles, black sulphide of iron separating during the change. On July 19, 1893, the temperature of the spring was 10·3° at half-past eleven, identical with that observed by Strecker towards the end of June, 1853; if the temperature is raised above this point, carbonic anhydride is liberated. The amount of solid matter dissolved in the water is very variable, and appears to fluctuate between 1·5 and 3 per cent. The quantity of hydrogen sulphide in 1000 c.c. is, on the other hand, fairly constant; it amounted to 34·26 c.c. in the summer of 1892, and 37·89 c.c. a year later. A complete analysis of the gaseous and solid substances dissolved in the water is given in the paper, showing that the quantities of carbonic anhydride and hydrogen sulphide have increased by 33 per cent. and 60 per cent. respectively during the last 50 years.

The *gytje* is a peculiar, dark grey mud which collects in sheltered bays along this coast. At Sandefjord the *gytje* is greasy to the touch, and has the odour of hydrogen sulphide; it is used for mud baths. A specimen, dried at 100°, gave the following results on analysis.

SiO_2.	Al_2O_3.	NaCl.	KCl.	K_2SO_4.	CaO.	$Ca_3P_2O_8$.	MgO.	FeO.
54·43	12·93	5·57	0·65	2·11	1·89	0·37	1·64	4·88

with organic matter (9·87), and chemically combined water 5·97, making the total 100·31. One thousand parts by weight of the moist substance contained 1·53 and 0·083 parts of ammonia and hydrogen sulphide respectively.

The water in the fjord itself, observed by Strecker to contain only 1·40 per cent. of salts, now contains almost twice this amount.

M. O. F.

Physiological Chemistry.

Composition of Normal Gastric Juice. By Adolf Schüle (*Chem. Centr.*, 1898, i, 347, from *Zeit. klin. Med.*, **33**, 543—546).—A case is described in which gastric juice was obtainable free from saliva; it contained some flakes of mucin; the free hydrochloric acid varied from 0·09—0·2 per cent.; the sp. gr. = 1·0012. The peptonising power of 3 c.c. was 50—55 per cent. (Hammerschlag's method); the juice did not invert cane-sugar, neither did it give the xanthoproteic reaction, nor the tests for albumoses or peptone. W. D. H.

Influence of Organic Foods on Inorganic Metabolism. By Angelo Pugliese (*Chem. Centr.*, 1898, i, 266—267; from Du Bois Reymond's *Archiv*, 1897, 473—485).—On the administration of carbohydrates and fats to dogs, the excretion of nitrogen and phosphates sinks; gelatin also causes a fall in the phosphates excreted. Sugar and, to a less degree, fat and gelatin, produce a rise in the output of sodium and potassium, the alkaline earths, however, not being affected. The total quantity of urine is lessened by feeding with sugar, but increased by intravenous injection of sugar. Very small quantities of sugar increase the output of nitrogen and phosphates.
W. D. H.

Oxidation of Acetone and Homologous Fatty Ketones [in the Organism].—By Leo Schwarz (*Chem. Centr.*, 1898, i, 264; from *Arch. exp. Path. Pharm.*, **40**, 168—194).—The separation of acetone is chiefly effected by the lungs. With doses of 0·2 to 1·6 grams per kilogram weight of the animal, 1—4 per cent. is found in the urine, and when larger quantities are administered, proportionately greater amounts are thus separated. Since very small quantities of acetone are not completely oxidised in the body, acetone cannot occur as an intermediate product of physiological action, and neither albumin nor carbohydrates yield acetone when oxidised with potassium permanganate. The power of oxidising acetone in dogs is not diminished by inducing diabetes in them by means of phloridzin, or by extirpation of the pancreas, but the organism is then able to form acetone from acetoacetic acid, whereas in the healthy animal acetoacetic acid, hydroxyisobutyric acid, β-hydroxybutyric acid, and mesityl oxide do not yield acetone. In the healthy organism, however, acetone is formed from acetoxime, and the mixed ketones of the fatty series are partly oxidised and partly excreted. Of the ketones examined, diethyl ketone is physiologically the most easily oxidised. E. W. W.

Presence of Manganese in Minerals, Plants, and Animals. By P. Pichard (*Compt. rend.*, 1898, **126**, 1882—1885).—Manganese seems to be universally diffused in rocks, plants, and animals. The author gives a list of 36 orders of plants, including both phanerogams and cryptogams, in which he has detected this element by the method previously described. It seems to be concentrated in the leaves and other parts of the plant that are in active growth, and especially in the seeds of phanerogams.

The proportion of manganese in animals is much smaller than in plants. It is noteworthy that the yolk of an egg contains much more than the white, an egg contains more than flesh, and flesh contains more than bones. C. H. B.

Comparative Chemistry of the Suprarenal Capsules. By B. Moore and Swale Vincent (*Proc. Roy. Soc.*, 1898, **62**, 352—354).—The suprarenal capsules of teleostean fishes resemble, anatomically, the inter-renal body of elasmobranchs, and the cortex of mammalian suprarenals. The chromogen present in the medulla of mammalian suprarenals is absent, and extracts of the teleostean capsules are physiologically inactive. No organ corresponding to the medulla is found in these fishes. W. D. H.

Presence of Organic Chlorine in Normal Urine. By Dioscoride Vitali (*L'Orosi*, 1897, **20**, 114—119; 145—153).—The question of the existence in urine of chlorine in various forms of combination is discussed, and an account is given of the experiments which have hitherto been made with a view to distinguishing between the chlorine present as chlorides and that existing in intimate combination with organic substances and incapable of being directly precipitated by silver nitrate. The results obtained by previous observers are criticised in detail, and sundry discrepancies therein are shown to be due to defective methods of analysis. That "organic chlorine" exists in urine to a small, but not insignificant, extent, is demonstrated by the following process, which appears to be free from sources of error. The urine is rendered distinctly acid with pure nitric acid, a slight excess of silver nitrate added, and the liquid filtered from the precipitated silver chloride. The excess of silver in the filtrate is removed by hydrogen sulphide, the liquid filtered, warmed to expel hydrogen sulphide, filtered again, mixed with potassium nitrate and excess of sodium carbonate, evaporated to dryness in a platinum dish, and incinerated. The residue is extracted with water, and to the filtered solution, after acidification with nitric acid, silver nitrate is added; the precipitate thus obtained is soluble in ammonia, but insoluble in boiling concentrated nitric acid, and does not, therefore, consist of silver cyanide, as has been suggested by some experimenters. Some experiments made with the object of ascertaining the nature of the organic chlorine compounds in urine, showed that they are not extracted from acid or alkaline urine by ether, chloroform, or light petroleum. N. L.

Phosphorus in Urine. By Leopold Jolly (*Compt. rend.*, 1898, **127**, 118—119).—Sometimes urine contains phosphorus in a form that is not precipitated even by a large excess of ammoniacal magnesium mixture, and this phosphorus has been supposed to exist in an incompletely oxidised form (Lépine and Aubert), or as phosphoglyceric acid. The author finds, however, that the urine of many patients suffering from nervous disorders or diathesia, and even the urine of healthy persons after an excess of food, contains peculiar nitrogen compounds which are not affected by the ordinary reagents for albumins and peptones, but are precipitated by tannin and by concentrated mercuric chloride solution. These nitrogen compounds retain some metallic phosphates in such intimate association that the phosphoric acid in them is not precipitated by magnesium mixture, and the author considers that it is these phosphates, and not phosphoglyceric acid or any incompletely oxidised form of phosphorus, that escapes precipitation by the ordinary method. C. H. B.

Elimination of Chlorides in Rachitis. By WILLIAM OECHSNER DE CONINCK (*Compt. rend.*, 1898, **127**, 72).—The urine in five cases of rachitis was found to contain chlorides (calculated as sodium chloride ?) ranging from 11·22 to 12·14 grams per litre. These results, corresponding with a considerable loss of chlorine, are in accordance with the author's views as to the nature of the disease. N. L.

Proteose in Urine. By HEINRICH ROSIN (*Chem. Centr.*, 1898, i, 74—75; from *Berlin. Klin. Woch*, **34**, 1044—1047).—In a female patient suffering from myelogenic sarcoma of the thoracic skeleton, a proteose resembling in general characters deutero-albumose was present in the urine. W. H. D.

Chemistry of Amyloid Degeneration. By N. P. KRAWKOFF (*Chem. Centr.*, 1898, i, 261—262; from *Arch. exp. Path. Pharm.*, 1897, **40**, 195—220).—The author describes the occurrence of chondroitinsulphuric acid in healthy and diseased men and animals. The amyloid substance is prepared from the various organs, the liver, kidneys, and spleen, from which the Glisson's capsule and the larger vessels have been removed, by treating them in small pieces with cold water and a dilute solution of ammonia. The mass is macerated on a nickel gauze sieve, and washed with dilute ammonia until the filtrate is free from chondroitinsulphuric acid. After washing with water, it is digested for several days with pepsin-hydrochloric acid, the mass then treated with ammonia, in which the greater part dissolves, and the amyloid precipitated with hydrochloric acid. The flocculent precipitate is washed with water, alcohol, and ether. The product contained C, 46·92; H, 6·60; N, 14·16, and P, 1·16 per cent. The phosphorus is due to the presence of nucleins which may be removed by treating the freshly-precipitated substance with baryta water. The amyloid gives the reaction with methyl-violet, but the reaction with iodine is dependent on its physical condition. Analyses of four preparations are quoted. The amyloid is insoluble in weak alkalis, and is a combination of chondroitinsulphuric acid with an albuminous substance; by the action of pepsin-hydrochloric acid, the latter is possibly converted into an albumose complex. In healthy organisms, the amyloid occurs so sparsely distributed in the walls of arteries, that the colour reactions are not apparent. E. W. W.

Pharmacology of Aconitine, Diacetylaconitine, Benzaconine, and Aconine. BY J. THEODORE CASH and WYNDHAM R. DUNSTAN (*Proc. Roy. Soc.*, 1898, **62**, 338—347).—*Action on the Circulation.* —Aconitine first stimulates the medullary centres, slowing the heart; acceleration follows, auricles and ventricles taking up an independent rhythm. Imperfect systole and delirium of the ventricles may follow. If the poisoning is slow, stimulation of the cardiac vagus ceases to produce the usual inhibitory effect. The vaso-motor centre is first stimulated, then depressed.

Diacetylaconitine produces in the main the same results, but in a less marked manner.

Benzaconine produces a preliminary acceleration of the pulse, and then slowing, with fall of blood pressure, ensues; this is due to the depression of the motor mechanism within the heart. The vaso-motor centre is depressed. Vagus stimulation causes slowing until a late stage of the poisoning is reached. Digitaline is an effective antagonist.

Aconine is comparatively harmless.

Action on Respiration.—Aconitine first stimulates, then depresses, the respiratory centre and the pulmonary sensory vagal fibres.

Diacetylaconitine produces a slighter initial stimulation; death results from central failure. Respiratory spasm occurs at death.

Benzaconine depresses the centres from the first. Respiratory failure is partly produced by action on motor nerve endings, and causes death without spasm.

Aconine slows the respiration, and has a pronounced curare-like action on the motor nerve endings.

Action on the Nervous System.—Aconitine produces no distinct narcotic effect, but the depression is secondary to diminution of oxidation processes from cardiac and respiratory failure. There is preliminary stimulation. Sensation is depressed.

Diacetylaconitine produces a similar, but less marked, effect.

Benzaconine causes a semi-narcotised condition, which is partly referable to low intracranial pressure. Sensory nerves are but little affected.

Aconine produces loss of volition in large doses.

Action on Oxidation.—Tested with vegetable protoplasm, all reduce oxidation processes, aconitine being the most, and aconine the least, active. All produce a fall of body temperature in the same order of activity.

Lethal Doses.—These are stated in fractions of a gram per kilo. of body weight for cat, rabbit, guinea-pig, and frog. The figures for the cat are:

Aconitine	0·000134
Diacetylaconitine	0·004 to 0·005
Benzaconine	0·0245
Aconine	0·16 to 0·4

General Conclusions.—The introduction of two additional acetyl groups into the molecule of aconitine slightly weakens, but does not materially modify, its action. The removal of the acetyl group so as to form benzaconine almost entirely annuls its characteristic actions. The withdrawal of the benzoyl group (as in aconine) reduces the toxicity still more. In fact, aconine and benzaconine are largely antagonistic to aconitine. W. D. H.

Chemistry of Vegetable Physiology and Agriculture.

Action of the Sorbose Bacterium on Xylose (Wood-sugar). By Gabriel Bertrand (*Compt. rend.*, 1898, **127**, 124—127).—When the bacterium of sorbose is allowed to grow in a decoction of yeast mixed with xylose, the latter is slowly, but almost completely, converted into xylonic acid. C. H. B.

Composition of the Mycelium of Mould Fungi. By Marschall (*Bied. Centr.*, 1898, **27**, 575; from *Arch. Hyg.*, **28**, 16—29; and *Chem. Centr.*, 1897, i, 115).—Analyses were made of *Aspergillus niger*, *Penicillium glaucum*, and *Mucor stolonifer* before fructification. The average percentage composition of the dry matter was found to be as follows.

Proteids.	Ether extract.	Alcohol extract.	Cellulose.	Starch.	Nitrog. extract sol. in water.	Ash.
38	5·27	14·03	5·03	2·8	28·47	6·37

The fungi occupy, therefore, as regards composition, a position between bacteria and the higher plants. N. H. J. M.

Germination. By F. Victor Jodin (*Ann. Agron.*, 1898, **24**, 382—390. Compare Abstr., 1898, ii, 129).—Experiments similar to those previously described were made with dead pea seeds, sterilised and not sterilised. The sterilised seeds remained practically inert, whilst the results obtained with the non-sterilised seeds seemed to indicate very active respiration. On repeating the experiment with live peas, the relation CO_2/O_2 was 1·00 with sterilised, and 1·23 with non-sterilised seeds, showing that the activity of live seeds is able to overcome the effect of microbes.

Pea seeds, seven years old, the germinative power of which was very much weakened, were covered with water. They did not germinate, but underwent a slight change, liberating carbonic anhydride and absorbing oxygen.

Cotyledons (of peas), after removal of the rudimentary plant, continued to give off carbonic anhydride, and retained a great part of the chemical energy of the seeds. But the nature of the change was entirely altered. Thus whilst during two successive periods of 5 days the relation, CO_2/O_2, was 1·41 and 0·84 with entire peas which had germinated normally, it was 14·08 and 2·15 in the case of the mutilated peas. N. H. J. M.

Effect of Formaldehyde on the Germination of Sugar Beet Seed. By Anton Stift (*Bied. Centr.*, 1898, **27**, 568; from *Oesterr. Zeit. Zuckerind.*, 1898, i.).—Beetroot seeds retained, without exception, their power of germinating, after remaining 24 hours in an atmosphere of formaldehyde (compare Windisch, Abstr., 1898, ii, 40). N. H. J. M.

The Presence of Simple Organic Compounds in the Vegetable Kingdom. By ADOLF LIEBEN (*Monatsh.*, 1898, **19**, 333—354). —It has previously been shown (Abstr., 1895, ii, 348) that the only product which can be isolated when carbonic anhydride is reduced with nascent hydrogen is formic acid. Experiments have now been undertaken to determine whether grass and the leaves of different trees yield formic acid or other volatile products when mixed with their own weight of acidified water (containing about 0·6 per cent. of sulphuric acid) and then subjected to distillation with steam. The faintly acid distillates were treated with sodium hydrogen carbonate and evaporated to dryness, and the solid residue examined for different acids. In all cases, formic and acetic acids, and a higher fatty acid, probably propionic, were obtained, the amount of acetic acid being greater than that of the other acids, although the amounts were invariably small; for example, from 72 kilos. of grass only 11 grams of the mixed barium salts were obtained. A small quantity of a higher crystalline acid was isolated which was practically insoluble in water, readily soluble in ammonia, fused readily, and gave insoluble lead and silver salts.

The neutral volatile products were obtained by distilling with steam and attaching a fractionating column to the flask; the distillate coming over was examined separately, and then the column was removed, the distillation continued, and the distillate examined for acids. Methylic and ethylic alcohols and a small quantity of oil were the only neutral products isolated, the amount of ethylic alcohol being always greater than that of methylic, and experiments indicated that this alcohol was only obtained after the vegetable tissue had remained for some time in contact with water.

In order to determine whether the acid and neutral products thus obtained were actually present in the leaves, &c., or were obtained by the action of the acidified water on the carbohydrates present in the tissues, the author subjected cane-sugar to an exactly similar treatment, and it was found that neither methylic nor ethylic alcohol was formed, but, apparently, when 5 or 10 per cent. sulphuric acid was employed, a small quantity of furfuraldehyde was produced. The volatile acids obtained from different carbohydrates, for example, filter paper, starch, and cane-sugar, were formic acid and a small quantity of a higher solid acid, probably identical with that obtained from leaves.

When cane-sugar was mixed with water acidified with tartaric acid and then subjected to distillation with steam, formic acid was the only volatile product isolated. J. J. S.

Physiological Meaning of Phosphoric Acid in the Organism of Sugar Beet. By JULIUS STOKLASA (*Bied. Centr.*, 1898, **27**, 537—539; from *Zeit. Zuckerind. Böhmen*, 1897, 403, and *Oesterr. Zeit. Zuckerind. u. Landw.*, 1897, 933).—Of the total phosphoric acid in beet seeds, 2·72 is in the form of lecithin. In seedlings six days old (sand-culture), the amount of phosphoric acid as lecithin was 6 per cent. of the total, and after 30 days, 9 per cent. was found in the leaves and stems, and 4·6 per cent. in the roots. In the case of plants grown under ordinary conditions, 6·3 per cent. of the phosphoric acid of the leaves was present as lecithin after 60 days, but only 5 per cent. in the roots. At the end of the vegetative period, when the outer leaves were yellow, the green leaves contained 0·89, and the yellow leaves only 0·15, per cent. of lecithin.

The dry substance of chlorotic beet contained only 0·22 per cent. of lecithin, whilst green leaves contained nearly 1 per cent. in the dry matter.

As leaves die off and the chlorophyll is destroyed, the lecithin migrates to the root, where it is stored up, chiefly in the head, presumably in anticipation of second year's growth. N. H. J. M.

Chlorophyll in a Nostoc grown in the Dark. By ALEXANDRE ÉTARD and BOUILHAC (*Compt. rend.*, 1898, **127**, 119—121).—A *Nostoc* grown in the dark on a solution of glucose containing certain salts, was found to contain a green chlorophyll, which gave the spectrum characteristic of the glaucophylls found in ordinary living leaves, except that the band λ548—536 had a much higher relative intensity than usual, being stronger than the band λ631—606, although not so strong as the band λ690—650. The alcoholic solution was yellowish-green with a distinct red fluorescence. Whether this chlorophyll possesses the ordinary chlorophyllien function was not ascertained. C. H. B.

Conditions of Development and the Composition of the Volatile Mustard Oils of the Seeds of the Cruciferæ. By GUNNER JÖRGENSEN (*Bied. Centr.*, 1898, **27**, 697—699; from *Tidskr. f. Fysik. og Kemi. Copenhagen*, 1898, **3**, 91—111).—The investigation was undertaken in consequence of the poisoning of cattle fed with rape cake. The cakes examined, which were stated to be rape cake, proved in some cases to consist of *Brassica napus* or *B. rapa*, in other cases the seeds of *Sinapis*, *Eruca* and *Erysimum* were found. Various *Brassica* seeds, unmixed, were also examined.

The cakes which acted corrosively on the digestive organs of the cows, did not show any considerable difference in the amount of mustard oil they produced. The composition of the mustard oils from different sources varied, however, considerably. In some cases (*Sinapis nigra* and *Brassica juncea*) the analytical results corresponded with the composition of allylthiocarbamide; in other cases (*Brassica glauca, B. dichotoma* &c.), the thiosinamine produced was a crotonylthiocarbamide.

The permanence of the pungent odour, produced by stirring with water and adding white mustard, was fairly proportional to the amount of "Indian seeds" in the cakes. Under the conditions of the experiments (the substance 5, mustard 1, water 100 grams, were kept at 40° in a closed 250 c.c. flask), the odour of mustard oil could still be detected after from 0—2 hours when no Indian rape was present, after 18—19 hours when the sample consisted mainly of Indian rape, after 26 hours with sarepta, and after 28 hours with black mustard.

N. H. J. M.

Microchemical Proof of the Presence of Alkaloids in Medicinal Drugs. By HERMANN BARTH (*Arch. Pharm.*, 1898, **236**, 354—367).—The paper contains the results of a number of experiments made on some drugs with the idea of determining in which cells or cell-complexes the alkaloids are to be found. In addition to the ordinary reagents, the following were often found to give good results :—vanadium sulphate, a sulphuric acid solution of cerium sulphate, and selenium sulphate and nitrate.

Some reagents, such as iodine, bromine, chlorine, hydrochloric and nitric acids, were employed in the form of vapour, thus permitting the use of a very powerful reagent, without dilution. Such reagents are strong enough to kill the plasma and convert the alkaloid, combined with an organic acid into an easily crystallisable salt. Many alkaloids for example, give crystalline substitution or additive products with the halogens, which are, however, easily soluble in water. Such compounds can, in the above manner, be easily detected by the microscope, or at all events when a polarising microscope is employed, as most of them are doubly refractive.

The results, which cannot well be abstracted, lead the author to the belief that the alkaloids are utilised during the germinating and development of the young plants, which is in agreement with Heckel's views (compare *Arch. Pharm.*, 1892, 555). A. W. C.

Formation of Proteids in Plants by the Reduction of Nitrates. By Alexandre Hébert (*Ann. Agron.*, 1898, **24**, 416—440).—The results of different investigators indicate that in the reduction of nitrates in plants, hydrogen cyanide is formed, and that this action usually takes place in those organs in which chlorophyll is present, and where the production of formaldehyde also predominates. After calling attention to the great combining power, and the facility of forming polymerides, which formaldehyde possesses, and the similar properties of cyanogen derivatives, it is suggested as probable that the two substances combine in the vegetable cells, yielding the more or less complex nitrogen compounds which form the fundamental products of the hydration of albumin.

N. H. J. M.

Amount of Nitrogenous Substances other than Proteids in Ripe Straw and Chaff. By Paul Holdefleiss (*Bied. Centr.*, 1898, **27**, 532—534; from *Habilitationsschr. Halle a-S.*, 1897).—The total nitrogen, and the pure proteids (by Stutzer's method) were determined in a large number of samples of the straw and chaff of various plants. The following is a summary of the percentage results relating to non-proteids :

	Cereals.				Leguminous.			
	Straw.		Chaff.		Straw.		Chaff.	
	Total.	In total proteids.	Total.	In total proteids.	Total.	In total proteids.	Total.	In total proteids.
Lowest..	0	0	0·049	3·49	0·058	5·39	0·078	6·05
Highest.	0·102	15·74	0·117	13·23	0·203	19·37	0·465	24·49
Mean....	0·049	7·29	0·085	8·19	0·123	11·74	0·244	12·25

N. H. J. M.

Amount of Nicotine in Retail Cigars and Tobacco. By Hugo Sinnhold (*Arch. Pharm.*, 1898, **236**, 522—529).—The amount of nicotine in European cigars, varies from 0·648 to 2·957 per cent. and in Havanna cigars from 0·972 to 2·241 per cent. Cigarette tobaccos contain 0·801 to 2·887 per cent., and pipe tobaccos 0·518 to 1·854 per cent. of nicotine.

The analytical methods employed were those of Kissling (*Zeit. anal. Chem.*, 21, 64; 22, 199), and Popovici (*Diss. Erlangen*, 1889).

A. W. C.

The Changes in Sugar when Stored. By Leopold Jesser (*Bied. Centr.*, 1898, **27**, 701—705; from *Oesterr. Zeit. Zuckerind.*, 1898, 35). **Behaviour of Raw Sugar when Stored.** By N. Rydlewski (*ibid.*, from *D. Deut. Zuckerind.*, 1897, 1413, and *Oesterr. Zeit. Zuckerind.*, 1897, 1202).—Raw sugar in quantities of 1 cwt., contained in sacks, was buried in sugar. The sacks were taken out from time to time, in order to obtain samples, in which the cane-sugar and the alkalinity were determined.

The results agree with those of previous investigators, in showing that the changes which sugar undergoes are not due to the composition of, at any rate, the normal non-sugars present, but to micro-organisms. The change does not progress uniformly. High alkalinity does not prevent the change, but when neutrality is reached reducing substances are produced in such amounts that they can be determined by ordinary methods.

In the early stages of decomposition, analysis is unable to decide whether the sugar is likely to change much or little when stored. As a rule, strongly alkaline sugar can be kept longest. Feebly alkaline sugar, however, is often well able to resist change, especially when sulphurous acid has been employed.

N. Rydlewski stored different sugars for 100, 200, and 300 days, and examined them by the usual methods. He concludes that there is no danger as long as the sugar shows an alkaline reaction. The preparation of the sugar, for example, with or without animal charcoal, has no effect if the alkalinity of the sugar amounts to 0·020 or 0·030.

N. H. J. M.

Production of Humus from Manures. By Harry Snyder (*Agr. Expt. Stat. Univ. Minnesota Bul.*, **53**, 1897, 12—35. Compare Abstr., 1898, ii, 449).—Cow manure, green clover, and meat scraps produce valuable, highly nitrogenous humus, capable of combining with the phosphoric acid and potash of the soil. Sawdust, straw, and carbohydrates produce humus rich in carbon, which has less power to combine with the phosphoric acid and potash of the soil than the more nitrogenous forms of humus.

Prolonged cropping produces less nitrogenous and more carbonaceous humus as compared with the humus of uncultivated land.

Forest fires may dissipate 75 per cent. of the total nitrogen of the soil, and the practice of burning over new land sometimes causes permanent injury to the soil.

Soils which are deficient in humus are sandy and sandy-loam soils, which have grown maize, potatoes, and small grains without application of stable manures or without the proper rotation of crops.

Prairie soil contains, per acre, about 1500 lbs. of phosphoric acid and 800 lbs. of potash combined with humus. After twenty years of cultivation, the amount of phosphoric acid is reduced to about 400 lbs. if the supply of humus is not kept up. N. H. J. M.

Production of Nitrogenous Manure. By JOSEF KÖNIG (*Bied. Centr.*, 1898, **27**, 667—671; from *Neue Zeit. Rübenzuckerind*, 1898, 1).—Attention is directed to the possibility of supplying a great portion of the nitrogen required in Germany for manuring, in the form of ammonium salts from gas-works and coke-furnaces. It is estimated that at least 230,000 tons of ammonium sulphate, containing 46,000 tons of nitrogen, could be produced annually as against 19,600 tons actually produced in 1898.

As regards the prevalent idea that nitrogen in the form of ammonia is less valuable than in the form of nitrates, it is pointed out that, whilst for spring manuring nitrates are preferable to ammonium salts (as most plants probably assimilate nitrogen in the form of nitrates), nitrates have the disadvantage that they are liable to give rise to the formation of a crust on the surface of the soil; they are also unsuited for autumn manuring owing to loss by drainage, and when used in large amounts they injure the quality of the crops.

The application of ammonium salts involves, in the case of soils poor in lime, more or less frequent addition of marl, lime, or basic slag; marl and ammonium salts may be applied simultaneously, but should be at once ploughed in.

Experiments have shown the relative values of ammonium sulphate and sodium nitrate to be 90—95 : 100. But when the disadvantages of sodium nitrate are taken into account, both forms of nitrogen may be considered equal. N. H. J. M.

Assimilation of Nitrates, and the Effect of Different Nitrates. By W. SCHNEIDEWIND (*Bied. Centr.*, 1898, **27**, 674—676; from *J. Landw.*, 1898, **46**, 1).—The results of experiments with sugar-beet manured with sodium and potassium nitrates respectively, indicated that the sodium salt gave a greater yield of dry matter and sugar in the roots, whilst the potassium salt produced a greater amount of leaf. The better effect of sodium nitrate is attributed to its greater solubility and diffusibility.

In the case of oats manured with various nitrates, the yield of grain was greatest with the magnesium salt; sodium nitrate gave the next largest amount of grain, then calcium, and, lastly, potassium nitrate. Magnesia has a special *rôle* in the production of grain; but it is supposed that the better result of sodium as compared with potassium nitrate is due, as in the case of sugar-beet, to the greater solubility of sodium salts, and to the consequent more rapid supply of nitrogen and phosphoric and sulphuric acids to the plant. Straw production was least with magnesium, and greatest with potassium nitrate.

The composition of the grain did not vary to any extent, except in the case of the magnesia plants, the grain of which was somewhat richer in magnesia. Most of the magnesia, however, was deposited in the straw.

It is not supposed that sodium can in any way replace potassium in its functions connected with the migration of starch and sugar.

N. H. J. M.

Experiments on the Effect of the Phosphoric Acid of Bone Meal. By JULIUS KÜHN (*Bied. Centr.*, 1898, **27**, 527—530; from *Deut. landw. Presse*, 1897, **24**, Nos. 62 and 63).—Bone meal, being sparingly soluble, is not very effective when applied for crops which occupy the land for short periods. Even the after-effect in such cases is inconsiderable, as, with ordinary soils, the phosphoric acid of bone meal remains, after the harvest, unchanged in the sparingly soluble, tribasic form. The effect is, however, essentially different in the case of crops such as winter wheat, perennial clovers, &c., and the appropriative power of plants such as winter rye is of importance.

Pot experiments were made, in which summer rye was grown in poor, sandy soil, without phosphate and with different amounts of various phosphates. The numbers given below show the percentage increase in produce over the unmanured pot. The amounts of phosphoric acid are given in kilos. per hectare:

	50 kilos. P_2O_5.		100kilos. P_2O_5.		200kilos. P_2O_5.		400kilos. P_2O_5.	
	grain.	straw.	grain.	straw.	grain.	straw.	grain.	straw.
Superphosphate	15	13	45	34	—	—	—	—
Basic slag	61	50	79	72	—	—	—	—
Degelatinised bone meal.	64	61	—	—	—	—	—	—
Steamed bone meal	45	50	58	46	76	58	77	60

With heavy soils, and with crops of long vegetative periods, it is best to employ superphosphate. With good, warm, average soil, both steamed bone meal and superphosphate may be used, whilst superphosphate alone should be applied to cold loams, or cold sandy loams. In the case of good sandy soil, superphosphate should not be used; both basic slag and steamed bone meal are suitable.

There will, perhaps, in future, be more competition between degelatinised bones and basic slag for light sandy soils than has hitherto been the case.

N. H. J. M.

Observations as to whether the Beneficial Action of Lime on the Soil of the Experiment Station is due to any extent to its Neutralising Action. By HOMER J. WHEELER, GEORGE M. TUCKER, and BURT L. HARTWELL (*Ann. Rep. Agr. Expt. Stat. Rhode Island*, 1896, **9**, 294—318).—The injurious effect which invariably resulted from the continuous application of ammonium sulphate to the soil of the Experiment Station could be overcome by simultaneous application of sufficient potassium carbonate, wood ashes, air-slacked lime, sodium carbonate, or caustic magnesia. Magnesium sulphate gave less satisfactory results, and the same holds, in a more marked degree, in the case of gypsum as compared with slacked lime. In experiments with

potatoes, gypsum failed to produce the beneficial effect observed with calcium carbonate, acetate, and oxalate, slacked lime and wood-ashes. Calcium acetate and oxalate are no doubt converted in the soil into carbonate (compare Schmoeger, *Ber.*, 1879, 755). It is concluded that, apart from the beneficial effect, both physical and manurial, of the above-named substances, they were probably, to a great extent, useful owing to a natural deficiency of bases in the soil and also in correcting acidity. Calcium chloride exerted a poisonous action (on potatoes).
N. H. J. M.

Analytical Chemistry.

Measurement of Gases. By Otto Bleier (*Ber.*, 1898, **31**, 2513).—The author finds the method recently described by him (Abstr., 1898, i, 183) for the absolute measurement of gases has been previously used by Hempel (*Verhdlg. Vereins. Beförd. Gewerbfl.*, 1894, 460).
A. H.

Crystals in Blowpipe Beads. By Wilhelm Florence (*Jahrb. f. Min.*, 1898, ii, 102—146).—A systematic account is given of the results obtained on heating various substances in borax and sodium phosphate beads with or without the presence of lead oxide; numerous figures are given of the crystals characteristic for each element so treated. The method is recommended for the microchemical determination of minerals in the dry way.
L. J. S.

Use of Ferrous Salts in Alkaline Solution as a Reducing Agent in Volumetric Analysis. By André Job (*Compt. rend.*, 1898, **127**, 59—60).—A solution made by adding an excess of sodium pyrophosphate to a solution of ferrous ammonium sulphate, is recommended as an alkaline reducing agent in volumetric analysis. When titrated with iodine or potassium permanganate, an operation which should be carried out in a current of hydrogen, the liquid remains colourless up to the end point, which is extremely sharp.

A solution of sodium pyrophosphate readily dissolves ferrous sulphide, and the green solution thus obtained is well adapted for the colorimetric estimation of small quantities of iron. The reaction is stated to be as delicate as that with potassium thiocyanate. The solution to be tested for traces of iron is mixed with a few drops of sodium pyrophosphate solution and one bubble of hydrogen sulphide passed in.
N. L.

Estimation of Moisture in Invert-sugar. By Leonard T. Thorne and E. H. Jeffers (*J. Soc. Chem. Ind.*, 1898, **17**, 114—116).—In consequence of the difficulty of drying invert-sugar in the ordinary way, it is usual to take the specific gravity (at 60° F.) of a 10 per cent. solution of the sample, and divide the excess of gravity over that of water (taken as 1000) by 0·386. This gives the percentage of dry sugar in the solution and the moisture in the sample is obtained by difference. When a notable amount of mineral matter is present this is estimated, the percentage is multiplied by 0·8, and deducted from the original excess gravity before calculating out the dry sugar (Heron).

To obtain a direct method of estimating the moisture, the authors have devised an apparatus for drying the sugar at 65—70° in a slow current of carbonic anhydride at a pressure of 50—80 mm. of mercury. For this purpose, the sugar is weighed on to the end of a coil of paper contained in a test tube (previously dried until constant in weight) and is then distributed over the paper by the addition of a few c.c. of water, with certain precautions. The test tube is then placed in a wider tube which is heated in the vapour of boiling methylated spirit, and whilst kept exhausted as completely as possible by a powerful and constantly working exhaust pump, a very slow current of carbonic anhydride is allowed to pass through the apparatus. The results agree very closely with those deduced from the specific gravity of the solutions provided that the ash is weighed after sulphating and $\frac{1}{20}$ deducted before multiplying by 0·8; also for invert-sugars, the factor 0·3888 given by Brown, Morris and Millar (Trans., 1897, 80), is employed instead of 0·386, which is the correct factor for saccharose.

M. J. S.

Use of a Solution of Phloroglucinol-vanillin for the Detection of Halogens in Organic Compounds. By P. N. RAIKOW (*Chem. Zeit.*, 1898, **22**, 20—21).—An alcoholic solution of phloroglucinol-vanillin has been successfully used for the detection of free hydrochloric acid in gastric juice; the author now states that it may be successfully applied to test for halogens in the products of combustion of organic substances.

The safest way is to operate as follows. A porcelain dish is rinsed with some of the reagent and then dried; a little of the substance to be tested is burnt on a platinum wire in a spirit lamp, or, if it is a gas, it is either burnt from a jet, or a current of it is passed through the spirit flame. If the dish coated with the reagent is inverted over the flame, the least trace of halogen acid formed will be indicated by the intensely red permanent coloration.

L. DE K.

Estimation of Oxygen in Copper. By MAURICE LUCAS (*J. Pharm.*, 1898, [vi], **8**, 311—312).—By varying the details of the silver nitrate method of estimating cuprous oxide in copper, the author has determined the conditions which are necessary to give concordant results agreeing with those obtained on reduction by hydrogen. It appears, also, that when cuprous oxide alone is treated, the amount of copper in the residue corresponds with that required by Hampe's equation, and that the action of silver nitrate on mixed cuprous oxide and copper gives the same result as its action on the separate components of the mixture. On immersing a sheet of copper in a neutral solution of copper nitrate, no precipitate containing copper is obtained on filtering.

W. A. D.

Estimation of Sulphur in Coal. By GEORGE L. HEATH (*J. Amer. Chem. Soc.*, 1898, **20**, 630—637).—The author rejects, for technical purposes, those processes which are based on fusing with an oxidising mixture, as this involves an evaporation in order to render any silica insoluble.

The best method is the one proposed by Eschka, provided that bromine is used as the oxidising agent; the details are as follows. One gram of the powdered coal is intimately mixed with 1 gram of pure light magnesia and half a gram of dry sodium carbonate, and heated in a 100 c.c. platinum dish with the flame of a large spirit lamp, at first very slowly; the mixture is frequently stirred with a platinum wire, and the whole is finally heated for 15 minutes at a low, red heat. When cold, the contents are transferred to a beaker, and boiled for 5 minutes with 100 c.c. of water and 15 c.c. of saturated bromine water; the filtrate is finally mixed with a slight excess of hydrochloric acid and then precipitated with barium chloride, with the usual precautions. L. DE K.

Estimation of Traces of Hydrogen Sulphide in the Air. By KARL B. LEHMANN (*Chem. Centr.*, 1898, i, 139; from *Arch. Hyg.*, **30**, 262).—*First method.*—Eight litres of air are drawn through 10 c.c. of N/100 iodine solution, at the rate of 6 litres in 30 minutes, by means of an aspirator, any traces of iodine which may be carried off by the current being caught in a trap containing an N/100 solution of sodium thiosulphate. From the loss in iodine, the amount of hydrogen sulphide is calculated.

Second method.—The same volume of air is passed through a glass tube 30 cm. long and 12 mm. wide containing a strip of filter paper 5 cm. long and 2 cm. wide which has been saturated with lead nitrate solution. If the paper turns pale yellowish-brown, the air contains about 1·4—2 parts of hydrogen sulphide per million; if dark brown, the amount will be from 3—5 parts, and if brownish-black, 8 or more parts may be present. L. DE K.

Titration of Combined Sulphuric Acid. By MAX REUTER (*Chem. Zeit.*, 1898, **22**, 357).—The author has tried Andrews' process (*Amer. Chem. J.*, 1880, **2**, 567), and finds that it gives excellent results if the titration with thiosulphate is made in a liquid containing only 5 c.c. of hydrochloric acid instead of 20; as this necessitates a longer contact with potassium iodide, the beaker should be covered with a watch-glass, and the air kept off by a surface current of carbonic anhydride.

The process, as will be remembered, consists in precipitating the sulphuric acid by means of a solution of barium chromate in hydrochloric acid. The excess of barium chromate is then removed by means of calcium carbonate, and the filtrate which contains an amount of soluble chromate equivalent to the sulphate is acidified with hydrochloric acid, mixed with potassium iodide, and titrated with sodium thiosulphate. L. DE K.

Estimation of Nitrogen by the Kjeldahl-Gunning Method. By K. WEDEMEYER (*Chem. Zeit.*, 1898, **22**, 21).—The author has proved by a number of experiments that the addition of potassium sulphate, as recommended by Gunning, to the usual mixture of sulphuric acid, phosphoric anhydride, and metallic mercury, considerably shortens the time of boiling without in the least interfering with the accuracy of the method.

NOTE.—Those who have read Gunning's original Dutch paper know that his chief object was to obviate the addition of potassium permanganate, salts of heavy metals, phosphoric anhydride, &c. L. DE K.

Detection of Nitrates in Milk by means of Formaldehyde. By E. FRITZMANN (*Chem. Centr.*, 1898, i, 218—219; from *Zeit. Öffl. Chem.*, 3, 610—614).—Nitrates, which, if present in milk, are a sure sign of the presence of adulteration with water, may be detected by adding to the milk a small quantity of formaldehyde, such as one drop of a 40 per cent. solution to 250 c.c. of the sample. On adding strong sulphuric acid, which should be chemically pure, a blue ring is obtained, and, on shaking, the liquid turns reddish- or bluish-violet. Too much formaldehyde interferes with the reaction; if, therefore, the reaction still shows when more of it is added, the amount of nitrates is considerable. L. DE K.

Estimation of Phosphoric Acid. By HENRI LASNE (*Compt. rend.*, 1898, 127, 62—64).—According to Vignon (Abstr., 1898, ii, 639), the sum of the amounts of phosphoric acid precipitated as ammonium magnesium phosphate from the solutions obtained by treating superphosphate, (1) with water, (2) with ammonium citrate solution, is always considerably less than the amount precipitated from the mixture of the two solutions. The author, in his large experience of superphosphate analysis, has never observed such a discrepancy, and quotes the results of three experiments in support of his opinion of the exactitude of the precipitation of phosphoric acid in presence of ammonium citrate. It is also maintained that ammonium magnesium phosphate is absolutely insoluble in a liquid containing one-third of its volume of ammonia of 22°, and experiments are described which show that even as little as a milligram of phosphoric acid in a litre of liquid is completely precipitated as the double salt. N. L.

Estimation of Phosphoric Acid. By LÉO VIGNON (*Compt. rend.*, 1898, 127, 191).—A reply to Lasne (preceding abstract). The author does not dispute the fact that the phosphoric acid soluble in citrate solution may be determined with accuracy directly, but maintains that his method of estimating it by difference offers the combined advantages of rapidity and accuracy. N. L.

Estimation of Phosphoric Acid for Physiological Purposes. By ALBERT NEUMANN (*Chem. Centr.*, 1898, i, 219—223); from *Du Bois Reymond's Arch.*, 1897, 552—553).—The destruction of the organic matter is effected by means of strong sulphuric acid and ammonium nitrate, 1 gram for every c.c. of the acid, the operation being conducted in a Kjeldahl flask and the substance introduced in two or three separate portions. To destroy the organic matter in 25 c.c. of urine, 10 c.c. of acid is required; for 25 c.c. of milk or 8 grams of fresh meat, 15 c.c.; and for 5 grams of dry fæces, 20 c.c. of acid is needed.

The phosphoric acid is then estimated gravimetrically or, if possible, by the volumetric uranium process. L. de K.

Method of Preparing a Strictly Neutral Ammonium Citrate Solution. By A. D. Cook (*J. Amer. Chem. Soc.*, 1898, **20**, 585—586).—Seven hundred and forty grams of citric acid is placed in a 4-litre measure containing 1900 c.c. of 10 per cent. ammonium hydroxide, the mixture is vigorously stirred until it is all dissolved. and the solution made up to the mark; after being again well stirred, it is transferred to a large porcelain evaporating dish and allowed to remain overnight; in the morning it will be found to be perfectly neutral both to corallin and cochineal. It is then diluted with water to a sp. gr. = 1·09 at 20°. L. de K.

Estimation of Citrate Soluble Phosphoric Acid in Bone Meals, Superphosphates, &c. By O. Böttcher (*Chem. Zeit.*, 1898, **22**, 201—202).—Five grams of the sample is repeatedly ground up with a solution of ammonium citrate containing free citric acid, and the whole introduced into a Stohmann's half-litre flask, which is then filled up to the mark with the citrate solution at 17·5°. After closing the flask with an indiarubber cork, it is rotated for 30 minutes in a suitable apparatus which turns 30—40 times per minute round its axis. The liquid is then filtered and 50—100 c.c. is used for the estimation of the phosphoric acid either by the molybdic or the magnesia method.

Preparation of the Citrate Solution.—One hundred and fifty grams of citric acid is put into a litre flask, dissolved in water, and exactly neutralised with ammonia; 10 grams of citric acid is then added, and the whole is made up to 1 litre. Before use, 1 volume of the solution is diluted with 4 volumes of water. L. de K.

Ignition of Magnesium Ammonium Phosphate. By Hugo Mastbaum (*Zeit. anal. Chem.*, 1898, **37**, 581—582).—With reference to the rapid method of igniting magnesium ammonium phosphate described by Schmöger (Abstr., 1898, ii, 455), the author states that even the preliminary drying of the precipitate is unnecessary, but that the wet precipitate, wrapped in its paper filter, may be placed in the platinum crucible and the latter at once exposed to the full flame of a Bunsen burner. The water assumes almost instantly the spheroidal condition, and no loss of precipitate takes place. After 15—20 minutes, the grey residue is moistened with strong nitric acid, which is then carefully evaporated. Exposure to the blowpipe flame for half a minute completes the ignition. M. J. S.

Volumetric Analysis of a Mixture of Alkyl Phosphates with Phosphoric Acid. By Jacques Cavalier (*Compt. rend.*, 1898, **127**, 60—61).—The composition of a mixture of phosphoric acid with the two alkyl phosphates, RH_2PO_4 and R_2HPO_4, where R is methyl, ethyl, or allyl, may be determined volumetrically by a process based on the behaviour of these compounds towards different indicators and on the different solubilities of the barium salts. The dialkyl hydrogen phosphate is acid to methyl-orange and to phenolphthalein, and is rendered neutral to both indicators by combination with one equivalent of alkali. The monalkyl dihydrogen phosphate is neutralised by one equivalent of alkali if methyl-orange is used as the indicator, and by two equivalents if phenolphthalein is employed; the barium salt is soluble in water. Phosphoric acid resembles the preceding compound in its behaviour with indicators, but the barium salt, $BaHPO_4$, is insoluble in water. The mixture of the three acids is first titrated with baryta water in the cold, using methyl-orange as indicator, and the liquid is then warmed to about 60° and the titration completed to the end point indicated by phenolphthalein. The first titration gives the sum of the three acids and the second the two polybasic acids, RH_2PO_4 and H_3PO_4. The liquid is now filtered from the precipitated barium hydrogen phosphate, and both precipitate and filtrate are mixed with excess of standard hydrochloric acid. The phosphoric acid and the monalkyl dihydrogen phosphate respectively contained in the two solutions thus obtained are then titrated with baryta water, the volume of alkali required to pass from the end point indicated by methyl-orange to that indicated by phenolphthalein being determined. The sum of the two results should be equal to that given by the second titration of the original mixture. N. L.

Separation and Estimation of Arsenic. By John Pattinson and Hugh S. Pattinson (*J. Soc. Chem. Ind.*, 1898, **17**, 211—214).—Arsenious sulphide requires for dissolution not more than 400,000 parts of hydrochloric acid of sp. gr. = 1·17 saturated with hydrogen sulphide. In the absence of hydrogen sulphide, the solubility is somewhat greater, although still very minute. Lead, cadmium, tin, antimony, and bismuth are not precipitated at all by hydrogen sulphide from acid of this strength, and the separation of arsenic from these metals is quantitatively complete. The precipitate may be washed with a mixture of 5 parts of hydrochloric acid and 2 parts of hydrogen sulphide solution without loss, and without risk of precipitation of the other metals. If the arsenic be in the form of arsenic acid, it may be reduced by stannous chloride before passing the gas.

The arsenious sulphide is best collected on an asbestos (Gooch) filter. After washing with acid, and then completely with water, it may either be weighed, or, if the quantity amounts to only a few centigrams, it may be heated with 10—15 c.c. of strong sulphuric acid in an uncovered beaker at a temperature at which the acid gives off white fumes. No loss of arsenic is to be feared if chlorides are absent. Hydrogen sulphide is first given off, then sulphurous anhydride; the acid darkens at first but becomes colourless when all the sulphurous anhydride is expelled. A clear solution of arsenious acid is thus obtained. The solution is then nearly neutralised with sodium hydroxide, rendered alkaline with excess of sodium hydrogen carbonate, and titrated with iodine. A blank experiment with the same sulphuric acid is desirable. Very accurate results are obtained.
M. J. S.

Volumetric Estimation of Boric Acid. By Vadam (*J. Pharm.*, 1898, [vi], **8**, 109—111).—In presence of an excess of mannitol, the quantity of boric acid present in a solution can be determined by adding decinormal caustic soda until an alkaline reaction with phenolphthalein or litmus is obtained; the end point of the reaction is more sharply defined than in Barthe's method, using glycerol (Abstr., 1896, ii, 337). In both cases, however, 1 c.c. of decinormal alkali is equivalent to 0·0062 gram of boric acid. The above method is available for determining boric acid in butter; 1·5 grams of the latter is extracted with warm water (20 c.c.), the free fatty acids present neutralised with decinormal caustic soda in presence of litmus, 1—2 grams of mannitol added, and the boric acid determined as above described. W. A. D.

Estimation of Potassium. By JULIUS DIAMANT (*Chem. Zeit.*, 1898, **22**, 99).—The author, finding a great difficulty in making potassium platinochloride perfectly anhydrous, now proposes the following process.

The double salt, which should weigh about 0·5 gram, is dissolved in boiling water in a 500 c.c. flask, and when cold is diluted to the mark, and 1 gram of zinc dust is added; this rapidly decomposes the compound, forming zinc and potassium chlorides. Two hundred and fifty c.c. is then pipetted off and titrated with N/10 silver nitrate; from the chlorine thus found, the amount of potassium chloride may be readily calculated. L. DE K.

Test for the Presence of Sodium Hydrogen Carbonate in Sodium Carbonate. By MELCHIOR KUBLI (*Arch. Pharm.*, 1898, **236**, 321—324).—The test for the presence of sodium hydrogen carbonate in sodium carbonate, as given in the *Pharmacop. German.*, III., and in the *Pharmacop. Ross.*, IV., is not sufficiently delicate, as, according to the author, it will not show the presence of 2 per cent. of the acid salt, and according to Thümmel (*Pharm. Central-H.*, 1891, 86) as much as 4—5 per cent. may escape detection. The author therefore proposes the following test, which depends on the fact that an aqueous solution of a soluble quinine salt of a certain concentration is not precipitated by normal sodium carbonate, if the latter does not contain more than 2 per cent. of sodium hydrogen carbonate.

Ten c.c. of a solution of quinine hydrochloride, containing 0·4 gram of the salt in 100 c.c. water, is added to 10 c.c. of the sodium carbonate solution (3 grams in 50 c.c. water); if there is not more than 2 per cent. of sodium hydrogen carbonate present, no permanent cloudiness is produced. The quinine solution should be preserved from air and light. A. W. C.

Estimation of Perchlorate in Chili Saltpetre. By OTTO FOERSTER (*Chem. Zeit.*, 1898, **22**, 357).—Ten grams of the sample is mixed with 10 grams of pure dry sodium carbonate and heated in a covered platinum or porcelain dish over the full flame until the fused mass flows quietly; this takes about 10 minutes. When cold, the mass, which can be readily detached from the dish, is dissolved in dilute nitric acid, and the total chlorine titrated by Volhard's method; after allowing for chlorine present in other forms, the difference is calculated to perchlorate. L. DE K.

Estimation of Lead in Ores. By FR. MOLDENHAUER (*Chem. Zeit.*, 1898, **22**, 256—257).—Two grams of the finely powdered ore is boiled with strong hydrochloric acid until hydrogen sulphide is no longer evolved; if much antimony is present, this may be practically expelled by evaporating to dryness two or three times with strong hydrochloric acid; the addition of a little nitric acid is advisable. The dry residue is now moistened with hydrochloric acid, 100 c.c. of water is added, the liquid boiled to dissolve the lead chloride, and the insoluble matter repeatedly washed with boiling water until quite free from lead; 300 c.c. generally suffices. The filtrate, heated to redissolve any deposited lead chloride, is nearly neutralised with ammonia, precipitated with hydrogen sulphide, and the lead sulphide collected, washed, and digested with ammonium sulphide. It is then treated, together with the paper, with nitric acid, evaporated to dryness, and after being heated to expel any sulphur and organic matter, is converted into sulphate by means of sulphuric acid; finally, the sulphate is freed from other metals by washing, dried, and weighed.

L. DE K.

Estimation of Traces of Lead in Water. By A. LIEBRICH (*Chem. Zeit.*, 1898, **22**, 225).—One, or more, litres of water is concentrated, acidified with acetic acid, precipitated with hydrogen sulphide, and the precipitate ignited and converted into sulphate by heating with a drop of sulphuric and nitric acid. The lead sulphate is then dissolved in a few c.c. of 10 per cent. aqueous potash, diluted to 20 c.c., mixed with 2 c.c. of freshly prepared ammonium sulphide, and the tint compared with that given by a standard solution of lead sulphate in aqueous potash containing 1 milligram of lead per c.c., and also diluted to 20 c.c. The experiment is then repeated, using more, or less, of the standard lead. By way of control, the lead sulphide may be again converted into sulphate and weighed. L. DE K.

New Volumetric Method for the Estimation of Copper. By RICHARD K. MEADE (*J. Amer. Chem. Soc.*, 1898, **20**, 610—613).—The solution of the copper ore is evaporated with sulphuric acid, the residue is dissolved in water, the greater part of the free acid neutralised with ammonia, and sulphurous acid added in excess; the copper is then precipitated by adding a slight excess of ammonium thiocyanate. The precipitate, collected on asbestos, is well washed and then put back into the beaker, where it is heated with aqueous (3 per cent.) potash; the suboxide thus produced is again collected on an asbestos filter, well washed with hot water, and then heated in a beaker with solution of pure ferric sulphate until it is entirely dissolved. The cuprous oxide sets free a corresponding equivalent of ferrous oxide, which is then titrated with permanganate, the iron equivalent of the permanganate multiplied by 1·125 giving the weight of the copper in the sample.

Instead of sulphurous acid, a mixture of equal weights of sodium hydrogen sulphite and potassium thiocyanate may be used to precipitate the copper. Ferric chloride may be used instead of ferric sulphate, but the titration with permanganate is then less safe. The process is not interfered with by the presence of arsenic, antimony, bismuth, or zinc. L. DE K.

Estimation of Copper in Vegetables. By VICTOR VEDRÖDI (*Chem. Zeit.*, 1898, **22**, 103—104).—This is a controversy with Lehmann on the subject of the occurrence of copper in vegetable substances. The author (Abstr., 1897, ii, 602) has found in the same samples a very much larger amount of copper than Lehmann did, and attributes this to the inaccuracy of the latter's colorimetric process. The author also expresses his view that the presence of even 0·8 gram of copper per kilogram of wheat does not constitute a danger to health, as the metal is there in the form of a harmless compound.

L. DE K.

Estimation of Copper in Vegetable Substances. By KARL B. LEHMANN (*Chem. Zeit.*, 1898, **22**, 296—297).—A reply to Vedrödi (preceding abstract). The author cannot understand the great differences in the amount of copper found by Vedrödi and himself in the ash of the same cereals, but he upholds his own views. L. DE K.

Estimation of Cuprous Oxide by Permangante. By ROBERT M. CAVEN and ALFRED HILL (*J. Soc. Chem. Ind.*, 1897, **16**, 981—983; **17**, 124).—Cuprous oxide dissolves completely and rapidly in a mixture of potassium permanganate and sulphuric acid, with formation of cupric sulphate and corresponding reduction of the permanganate. One part of sulphuric acid is diluted with 3 parts of water, and 4 volumes of this acid is added to 1 vol. of standard permanganate. The cuprous oxide, collected and washed on an asbestos filter, is introduced into a measured excess of this mixture, and after stirring for a minute or two the unreduced permanganate is titrated with oxalic acid. Highly satisfactory results are obtained with great rapidity. M. J. S.

Quantitative Separation of Metals by Hydroxylamine and Hydrazine. By PAUL JANNASCH (*Ber.*, 1898, **31**, 2377—2394).—[With G. DEVIN.]—Mercury may be separated from copper, bismuth, lead, cadmium, arsenic, antimony, or tin, in solutions of their salts, by the employment of an ammoniacal solution of hydroxylamine. A mixture of mercuric chloride and a salt of one of these metals is dissolved in water, or in hydrochloric acid if necessary, tartaric acid, ammonia, and hydroxylamine hydrochloride are added in excess, and the solution heated until the precipitation of mercury is complete; the latter is then collected, redissolved in fuming nitric acid, the solution evaporated to dryness, the residue taken up with hydrochloric acid and water, and the mercury precipitated as sulphide. From the ammoniacal filtrate, the remaining metal may be separated by suitable means, the copper as cuprous thiocyanate, the bismuth, lead, cadmium, antimony, and tin as sulphides, and the arsenic as magnesium ammonium arsenate. The copper, cadmium, bismuth, and tin are finally weighed as oxides, the lead as sulphate or peroxide, and the antimony as sulphide or oxide.

[With F. ALFFERS.]—In a similar manner, mercury is separated from molybdenum or tungsten by ammoniacal hydroxylamine in the presence of tartaric or citric acids; the precipitated metal is treated as described above, whilst from the filtrate the molybdenum is obtained as sulphide and weighed as trioxide.

The separation of mercury from aluminium, chromium, or manganese is effected by the same reducing agent in the presence of oxalic acid; aluminium and chromium are obtained as oxides, whilst the manganese is precipitated from the ammoniacal filtrate by hydrogen peroxide and weighed as the protosesquioxide. Tartaric or citric acid may be substituted for oxalic acid in the case of these metals, but its use is less convenient.

Mercury and cobalt are separated by the addition of ammoniacal hydroxylamine to the slightly acid solution of their salts, the cobalt being precipitated as sulphide in the filtrate from the mercury.

Mercury and nickel are similarly separated in the presence of an organic acid such as tartaric or citric. Either of these acids or oxalic acid may be employed in the separation of mercury from uranium by ammoniacal hrdroxylamine, the latter element being determined by evaporating the filtrate to dryness, igniting, and weighing both as U_3O_8 and UO_2.

[With Wilhelm Heimann.]—Selenium, either in the form of selenious or selenic acid, is separated from sulphuric and phosphoric acids by boiling their solutions with excess of hydroxylamine hydrochloride, the selenium being precipitated and weighed, whilst the sulphuric and phosphoric acids in the filtrate are determined in the usual way. The separation of tellurous or telluric acids from sulphuric or phosphoric acids is effected in the same way.

[With M. Müller.]—An ammoniacal solution of hydroxylamine reduces tellurous and telluric acids, causing the complete precipitation of the tellurium, whilst an acid solution of this reagent is without action on these acids; hydroxylamine may therefore be employed in separating selenium and tellurium. The selenium is completely precipitated when a hydrochloric acid solution of these elements is boiled with hydroxylamine, and the tellurium separates quantitatively when the filtrate is rendered ammoniacal and boiled with more of the reducing agent; four molecules of hydroxylamine are required for the reduction of one molecule of selenious acid, water and nitrogen being produced at the same time.

Tellurium is separated from palladium by distilling an alloy of these elements in a current of bromine, the tellurium bromide is volatilised and received in hydrochloric acid, and the solution reduced with ammoniacal hydroxylamine; the residue containing the palladium is dissolved in aqua regia, the metal precipitated as sulphide, and finally weighed as PdO_2 and also in the metallic state.

Selenium is most conveniently separated from barium by means of hydroxylamine. Barium selenite dissolved in hydrochloric acid is boiled with excess of the reducing agent, and the selenium is collected and weighed; the barium remains in the filtrate and is estimated as sulphate.

[With M. Müller.]—Hydrazine sulphate reduces selenium compounds even more energetically than hydroxylamine and precipitates selenium both from hydrochloric and nitric acid solutions.

Tellurium is also precipitated from its hydrochloric acid solution by this reagent but not from the solution in nitric acid; from a hot ammoniacal solution, hydrazine precipitates it quantitatively, and the reduction of this element from its salts by hydrazine and by hydroxylamine is being employed in the determination of its atomic weight.

G. T. M.

Detection of Cobalt in the Presence of Nickel. By Adam Jaworowski (*Chem. Centr.*, 1898, i, 144; from *Pharm. Zeit. Russ.*, **36**, 632—634).—The liquid, if containing free acid, is neutralised with sodium carbonate, and solid sodium pyrophosphate is added until the turbidity at first produced has again disappeared; the liquid, after being poured off from any undissolved pyrophosphate, is, if necessary, diluted with water until nearly colourless, and 6—8 c.c. of this solution is shaken with 1—1·5 grams of sodium carbonate and 5—8 drops of bromine water; if cobalt be present, even in traces, the liquid will be of a beautiful green when observed in reflected light. L. de K.

Oxidation of Cobalt Salts in Presence of Alkalis. By André Job (*Compt. rend.*, 1898, **127**, 100—103. Compare McConnell and Hanes, Trans., 1897, 584).—It is well known that when hydrogen peroxide or bromine is added to a solution of potassium hydrogen carbonate mixed with a cobalt salt, the pink colour of the solution changes to green, but the composition of the green compound has not hitherto been ascertained. By titration with the special ferrous reagent proposed by the author (this vol., ii, 51), he finds that the ratio of cobalt oxide to active oxygen is 2Co : O. Hence the green compound is a derivative of the oxide Co_2O_3; its exact formula is $Co_2(OH)_4(HCO_3)_2$.

The oxidation of the cobalt in presence of an alkali followed by the titration of the green compound with the ferrous reagent and iodine affords a rapid and very accurate means of estimating cobalt in presence of iron or nickel. Any excess of hydrogen peroxide soon decomposes or may be expelled by boiling the liquid for a few minutes.

The best plan is to add the solution containing the cobalt salt to a mixed solution of potassium hydrogen carbonate and hydrogen peroxide, heat gently for a few minutes and then titrate.

C. H. B.

Analysis of Swedish Magnetic Iron Ores. By Th. Wetzke (*Chem. Centr.*, 1898, i, 144; from *Zeit. Öffl. Chem.*, **3**, 575—577).—The solution in hydrochloric acid is effected by micro-burners so as to avoid boiling, and the vessel is covered; the iron is finally titrated with permanganate, any sulphurous insoluble residue being examined by Hauffe's method. Phosphorus is best estimated by the process recommended by Meineke (Abstr., 1897, ii, 157), namely, ignition of the phosphomolybdate precipitate in a Gooch crucible.

L. de K.

Estimation of Tin in Tin Plate. By Robert Job (*J. Soc. Chem. Ind.*, 1898, **17**, 325—326).—In a 200 c.c. flask, about 100 c.c. of pure hydrochloric acid of sp. gr. = 1·2 is placed, a piece of marble weighing about 5 grams is dropped in, and the flask is closed with a perforated cork fitted with a Bunsen valve. After about 5 minutes, 4 square inches of the tin plate, from the middle of a sheet, cut into strips, is dropped into the acid, and the flask is heated until the action becomes vigorous. When the plate is nearly dissolved, another fragment of marble is added, and immediately the plate is entirely dissolved, and while effervescence from the marble still continues, the flask is cooled as rapidly as possible to 0°. It is then filled to the mark with ice cold water, the contents mixed, and 50 c.c. of the solution titrated with iodine (1 c.c. = 0·00056 gram of tin). A fresh quantity of the iodine solution equal to that required in the first titration is then placed in a flask, and 50 c.c. of the tin solution delivered into it, keeping the point of the pipette just below the surface; in this way, oxidation by air is completely avoided. A little starch is added and the titration finished with the iodine. M. J. S.

Electrolytic Estimation of Tin in Tin Ores. By EDWARD D. CAMPBELL and E. C. CHAMPION (*J. Amer. Chem. Soc.*, 1898, **20**, 687—690).—One gram of the finely ground ore is fused with 3 grams of sulphur and 3 grams of sodium carbonate in a covered porcelain crucible inserted in a larger one; this is then placed on a triangle and covered with a Hessian crucible, the bottom of which has been removed. After being heated for an hour to a full red heat, it is allowed to cool, the inner crucible is placed in a beaker with water to dissolve the soluble tin compound, and the insoluble portion is again fused with soda and sulphur and the two filtrates are united. Hydrochloric acid is now added until all the tin is precipitated, and the liquid is evaporated to about 75 c.c., mixed with 10 c.c. of hydrochloric acid, and fully oxidised by means of sodium peroxide. After filtering off from any sulphur, ammonia is added to the filtrate until the liquid becomes slightly turbid, and then 50 c.c. of a 10 per cent. solution of ammonium hydrogen oxalate is added, which will cause the solution to become clear. The liquid is now electrolysed during a night with a current N.D. 100 = 0·10 ampère with an E. M. F. of 4 volts. This will cause the metal to be completely precipitated as a pure white, firmly adhering coating upon the platinum dish, and after being washed first with warm water, and then with alcohol, it is dried and weighed. The dish, cleaned by dissolving off the tin with hydrochloric acid, is washed, dried, and weighed. L. DE K.

Estimation of Tin in Commercial Antimony. By JOHN PATTINSON AND HUGH S. PATTINSON (*J. Soc. Chem. Ind.*, 1898, **17**, 214—215).—In this process, advantage is taken of the very sparing solubility of antimony pentasulphate in cold strong sulphuric acid. About 6·5 grams of the pulverised metal is heated with 75 c.c. of sulphuric acid of sp. gr. = 1·83 until completely dissolved, which requires about 10 minutes, and then allowed to cool completely, when the greater part of the antimony sulphate crystallises out, whilst the tin, arsenic, copper, iron, and other impurities (except lead) remain in solution. The whole is thrown on an asbestos filter, the precipitate washed several times with sulphuric acid (sp. gr. = 1·83), and the filtrate diluted with 3 times its volume of water, cooled, nearly neutralised with ammonia, and treated with an excess of strongly yellow ammonium sulphide. All the metals except tin, arsenic, and antimony are precipitated, and are filtered off and washed with ammonium sulphide. The filtrate is then feebly acidified with dilute sulphuric acid and the sulphides of tin, arsenic, and antimony collected and washed. The precipitate is next boiled with a solution of bromine in strong hydrochloric acid, any sulphur which separates is oxidised by fuming nitric acid, and the united solutions are boiled until free from bromine. The greater part of the acid is now neutralised by ammonia, and the tin is separated from the other metals by Clarke's oxalic acid process, for which purpose oxalic acid is added to saturation and hydrogen sulphide passed through the hot solution; this throws down the arsenic and antimony, whilst the tin remains in solution. Finally, the filtrate is nearly neutralised with ammonia, an excess of ammonium sulphide added, and the stannic sulphide thrown down by acetic acid.

M. J. S.

Assay of Telluride Ores. By Charles H. Fulton (*J. Amer. Chem. Soc.*, 1898, **20**, 586—597).—As telluride ores, when assayed for gold and silver, give less accurate results than other auriferous minerals, the author has made a laborious investigation into the cause of this, and has now greatly improved the process.

If the ore is very poor, 1 assay-ton of the powder is mixed with the same amount of dry soda, and half its amount of silica; 1—6 assay-tons of litharge, 10 grams of borax glass, and 2 grams of argol are added, and the whole well mixed and covered with salt. If traces of silver are likely to be present, an extra 0·02 gram of this metal is added, and also 4 iron nails to assist in desulphurising the ore. In dealing with rich ores, only one-fifth of an assay-ton is used with at least 2 assay-tons of litharge, 1 assay-ton of soda, and 1 gram of argol. The fire should be moderately hot, and the fusion should last from 40—50 minutes; the lead button obtained should weigh about 20—28 grams, and be, if possible, submitted at once to cupellation without previous scorification.

The traces of gold absorbed by the cupel may be disregarded, but the slag should always be powdered and remelted with another assay-ton of litharge and 2 grams of argol; the button formed is then also cupelled.

L. de K.

Examination of Otto of Roses. By P. N. Raikow (*Chem. Zeit.*, 1898, **22**, 149—150).—Dietze has proposed the following standard tests for the purity of otto of roses. (1) The sp. gr. at 15° should not exceed 0·870. (2) The solidification point should not be below 15—20°. (3) The rotatory power observed in a 100 mm. tube at 20° should not exceed $-1° 30'$. (4) The saponification number should not exceed 9·5—10, and the relation between the acid and ether numbers not be higher than 7.

The author having tested the process with two samples of otto of roses of undoubted genuineness, states that the tests do not safeguard against an adulteration with oil of geranium.

L. de K.

Technical Analysis of Asphaltum and Asphalts. By Stephen F. Peckham (*J. Soc. Chem. Ind.*, 1898, **17**, 438—439).—For technical purposes, a more or less empirical examination is of greater value than a scientific analysis, and it is of primary importance to ascertain what proportion of the mineral is soluble in light petroleum, boiling oil of turpentine, and chloroform respectively. If the "organic matter not bitumen" is large in amount, its nature should be ascertained. The amount and form of combination of the sulphur is next in importance, then the amount of the nitrogen and, lastly, that of the iron and aluminium. The solvents used should be carefully freed from water. Quantities of the mineral containing about 0·5 gram of bitumen are weighed into two 11 cm. extracted filters of known weight, placed in stop-cock funnels; the filters are filled with light petroleum which is allowed to run off slowly until the colour has perceptibly diminished, then the stop-cock is kept closed for 15—30 minutes after each addition of solvent and the last digestion should extend to 12 hours. The filters are dried at 66° and weighed. They are then exhausted with boiling oil of turpentine which is displaced by light petroleum before drying; the same filters are then exhausted with chloroform. They may next be extracted with 10 per cent. hydrochloric acid which removes calcium and magnesium carbonates and calcium sulphate; and lastly, they are deflagrated with sodium carbonate and potassium nitrate, and the sulphur present as pyrites, silica, iron, and aluminium are estimated in the fused mass. For total sulphur, a fresh portion of the mineral is deflagrated in the same way. Another portion is dissolved in benzene, the solution washed with dilute (10 per cent.) sulphuric acid, and the acid solution is treated with sodium nitrate when any nitrogenous basic oils present will be recognised by their odour. Another portion is exhausted with chloroform, and the residue extracted with ammonia for peat acids. Free sulphur will be found in the petroleum extract, organic aluminium compounds in the turpentine solution. Nitrogen may be determined by any method. The interpretation of the analytical results is reserved for a later communication. M. J. S.

Estimation of Glycerol. By FREDERIC WILLIAM RICHARDSON and ADOLF JAFFÉ (*J. Soc. Chem. Ind.*, 1898, **17**, 330—333).—The only trustworthy methods for the estimation of glycerol are the dichromate and the acetin methods (Abstr., 1890, 425), and of these the dichromate process is the simpler and more satisfactory. The authors depart slightly from Hehner's instructions, relying on basic lead acetate for the removal of chlorides as well as of organic impurities, removing the excess of lead by dilute sulphuric acid and filtration before adding the dichromate. They recommend somewhat different proportions, namely, 20—25 c.c. of the glycerol solution, 25 c.c. of dichromate (Hehner's solution, of 74·86 grams per litre: 1 c.c. = 0·01 gram of glycerol), and 25 c.c. of concentrated sulphuric acid, and find that 20 minutes heating in the water-bath completes the reaction.

It is possible to estimate the glycerol in commercial samples by using a table of specific gravities, but it is necessary to determine the ash and to deduct certain constants from the specific gravity, in order to correct for the organic impurities usually present; these constants require to be varied for different percentages. M. J. S.

Estimation of Phenols in Disinfectants in the Presence of Soap. By WERNER SPALTEHOLZ (*Chem. Zeit.*, 1898, **22**, 58).—The following process is recommended for testing compounds which contain the phenols in the free state; the sample is heated in an iron retort to 200°, and steam is passed through it until oily drops no longer come over with the distillate. The temperature during the distillation should not exceed 210°, as otherwise any olein soap which may be present will undergo decomposition; rosin soap, however, may be heated without decomposition to 220°. The distillate is shaken with benzene to dissolve the phenols, and the benzene is then agitated with aqueous soda and the phenols precipitated from the alkaline solution by means of an acid. L. de K.

Estimation of Small Amounts of α-Naphthol in Commercial β-Naphthol. By John Procházka and H. N. Herman (*J. Soc. Chem. Ind.*, 1897, **16**, 894—895).—The method is based on the fact that α-naphthol combines with diazo-compounds more readily than β-naphthol does, and forms more soluble products. The diazo-compound employed is that of 1 : 4-naphthylaminesulphonic acid (naphthionic acid): 27·5 grams of (90 per cent.) sodium naphthionate is dissolved in 185 c.c. of water, 6·2 c.c. of concentrated sulphuric acid is diluted to 186 c.c. and slowly added with stirring, the mixture is cooled below 5°, and 7 grams of (98 per cent.) sodium nitrite in a 10 per cent. solution is slowly added; the paste obtained in this way is made up to 750 c.c. The β-naphthol solution is prepared as follows: 1·5 grams of β-naphthol, 200 grams of a 25 per cent. solution of sodium hydroxide, and 140 grams of a 10 per cent. solution of sodium carbonate are heated together until the β-naphthol is dissolved, and the solution is made up to 250 c.c. and cooled below 5° before use. To this β-naphthol solution, 37·5 c.c. of the diazo-solution (being $\frac{1}{20}$ of the theoretical amount) is slowly added with stirring. If the β-naphthol solution is pure, the colour produced is entirely insoluble, but the presence of less than 10 per cent. of α-naphthol is indicated by a peculiar bluish tint and the production of a coloured supernatant liquid. The amount of α-naphthol can be very fairly estimated by dipping strips of filter paper into this liquid, and comparing the depth of tint with that produced by a solution of known composition. M. J. S.

Paranitraniline Red. By Adolf Liebmann (*J. Soc. Chem. Ind.*, 1897, **16**, 294—296).—Quantities of α-naphthol greater than 0·1 per cent. present in the β-naphthol used for preparing paranitraniline red, are deleterious as regards the colour of the resulting dye. β-Naphthol can readily be freed from α-naphthol by crystallising it from toluene, washing the crystals first with a mixture of toluene and light petroleum, then with the latter alone, steaming, and crystallising the steamed product several times from boiling water.

For determining the quantity of α-naphthol in β-naphthol, the following process gives good results even when 0·01 per cent. only of the former is present; 0·144 gram of the β-naphthol is dissolved in 5 c.c. of absolute alcohol contained in a graduated test-tube, and the solution made up to 15 c.c. with pure toluene; 0·14 gram of paranitraniline dissolved in 9 c.c. of dilute hydrochloric acid is then cooled and diazotised with 1 c.c. of normal sodium nitrite, and 1 c.c. of the diazo-solution added to the tube containing the β-naphthol. Water is then added, the toluene solution separated and shaken with 5 c.c. of normal caustic soda, and the colour of the alkaline solution compared with that of the alkaline solution obtained in exactly the same way from β-naphthol containing a known quantity of α-naphthol. The test is based on the fact that the hydroxyazo-derivative obtained from α-naphthol and paranitraniline is soluble in alkalis, whereas the corresponding β-naphthol derivative is insoluble.

The following method of estimating metanitraniline in paranitraniline is available when more than 0·1 per cent. of the former is present. 0·25 gram of the paranitraniline is reduced to paraphenylenediamine by zinc dust and hydrochloric acid in a flask which permits gas to escape and yet does not allow air to enter; the colourless solution is then quickly filtered and diluted to 250 c.c. 0·25 gram of metanitraniline is reduced in the same way, and made up to 250 c.c. Ten c.c. of the paraphenylenediamine solution is then diluted to 50 c.c., and a drop or two of dilute sodium nitrite added; if the paranitraniline is pure, only a very slight change in colour occurs. If, however, metanitraniline is present, a light brown coloration (Bismarck brown) is produced; by comparing the latter with that obtained from a known quantity of the standard metaphenylenediamine solution, the amount of metanitraniline can be determined. W. A. D.

Estimation of Sugars as Osazones. By Carl J. Lintner and Krober (*Ann. Agron.*, 1898, 24, 448; from *Zeit. Brauwesen*, 1896, 153).—Twenty c.c. of the solution, which should not contain more than 1 per cent. of sugar, is heated for one hour and a half on a water bath with phenylhydrazine (1 gram) and 50 per cent. acetic acid (1 gram). In presence of dextrin, the heating must be prolonged to 2 hours. Boiling water (20 c.c.) is then added, and the osazone collected on a tared filter, dried at 110° for 3 hours, and weighed.

Saccharose, which is not completely inverted by acetic acid, is first inverted with hydrochloric acid; sodium acetate is then added, and the process continued as described.

The method is suitable for dextrose, levulose, and saccharose both alone and in presence of maltose and dextrins; the latter increase the weight of the osazone slightly. N. H. J. M.

Detection and Estimation of Glucose in Diabetic Urine. By A. Carpené (*L'Orosi*, 1897, 20, 157—160).—A quantity of urine containing not more than 0·2 gram of glucose is, if acid, neutralised with potash or, if alkaline, boiled to expel ammonia, mixed with a slight excess of lead acetate solution, filtered, and the precipitate on the filter washed with water. Five or six grams of glycerol are added to the filtrate and washings, and the liquid is then mixed with six times its volume of alcohol of 95—96°, filtered again if necessary, and about 10 c.c. of baryta water added. If glucose is present, a precipitate is produced, which may be collected, washed with alcohol of 95—96°, and converted into barium sulphate in the usual manner. Each decigram of the sulphate corresponds with 0·0772 gram of glucose. The test analyses given are very satisfactory. The glycerol in this process is added to prevent the precipitation of barium hydroxide by the alcohol. According to the author, the precipitate which glucose forms with baryta has the composition $BaC_6H_{10}O_6$, and not $Ba(C_6H_{11}O_6)_2$, as usually stated. N. L.

Clerget's Method of Estimating Saccharose. By Arthur R. Ling (*J. Soc. Chem. Ind.*, 1898, 17, 110—111).—The author gives results confirmatory of Herzfeld's well-known formula, $S = \frac{100K}{142{\cdot}66 - 0{\cdot}5t}$, which is used when K stands for the difference between the readings of the Soleil-Ventzke-Scheibler polariscope, before and after the inversion of 26·048 grams of saccharose per 100 c.c. It is customary to make the solution after inversion of only half this strength, and to multiply the observed reading, i, by 2 before deducting it from the original reading. If any quantity other than 13·024 grams of sugar is inverted and diluted to 100 c.c., the formula becomes $S = \frac{100K}{141{\cdot}84 + 0{\cdot}05i - 0{\cdot}5t}$.

M. J. S.

Modification of Clerget's Saccharimetric Process, applicable to After Products, and Molasses. By ARTHUR R. LING and JULIAN L. BAKER (*J. Soc. Chem. Ind.*, 1898, **17**, 111—114).—The authors recommend the use of invertase (compare O'Sullivan, Trans., 1886, **58**; 1891, 46) instead of hydrochloric acid for the inversion of saccharose, on the ground that, in highly impure substances, its hydrolytic action is more likely to be confined to saccharose than that of a mineral acid, and they show by experiments on pure sugar that identical results are obtained with the two inverting reagents. Satisfactory agreement is shown between duplicate determinations made by this process on various dark commercial products.

M. J. S.

Estimation of Sugar in Chocolate. By P. CARLES (*J. Pharm.*, 1898, [vi], **8**, 245—257).—The optical method of determining sugar in chocolate is inaccurate, because it neglects to take into account the volume occupied in the solution by dissolved cocoa, and the rotation often caused by the latter. The values obtained by cupric reduction are also high, since, after inversion, substances, other than dextrose, which reduce Fehling's solution are often present. The following process, however, gives good results: 16·20 grams of the chocolate in thin shavings is heated with 80 c.c. of water during 1½ hours on the water-bath, 2—3 c.c. of a solution of basic lead acetate added, the mixture well shaken, and, after being diluted to 100 c.c. with water, filtered, and the amount of sugar determined by the saccharimeter. If N denotes the value thus obtained, the true percentage of sugar = 0·919 N.

W. A. D.

Estimation of Cellulose. By GEORG LEBBIN (*Ann. Agron.*, 1898, **24**, 352; from *Arch. Hyg.*, 1897, **28**, 213).—The finely powdered substance (3 to 5 grams) is heated to boiling with 100 c.c. of water, for half an hour, to gelatinise the starch; 20 per cent. hydrogen peroxide (50 c.c.) is then added, and the boiling continued for 20 minutes, during which time 5 per cent. ammonia (15 c.c.) is added, 1 c.c at a time. The mixture is then boiled for 20 minutes longer, filtered through a tared filter, the precipitate washed with boiling water, dried, and weighed; the weight of the ash is afterwards deducted. In some cases, the nitrogen is determined and the corresponding amount of protein also deducted. Concordant results, obtained with rye and wheat bran and with wheat grain, are given.

Filter paper treated with hydrogen peroxide and ammonia lost 2·72 to 5·65 per cent. N. H. J. M.

Estimation of Crude Fibre in Fodders and Foods. By Josef König (*Bied. Centr.*, 1898, **27**, 706—711; from *Zeits. Unters. Nahrungs. u. Genussmittel*, 1898, 3).—The air-dried substance (3 grams), contained in a dry 500 c.c. porcelain dish, is stirred with nearly 200 c.c. of glycerol (sp. gr. = 1·230) containing 30 c.c. of strong sulphuric acid per litre, the rest of the 200 c.c. being used to rinse the glass rod, when done with, into the dish; the dish is then placed in an autoclave and heated for an hour at 137° (3 atmospheres pressure). When cooled to 80—100°, the contents of the dish are diluted with 200—250 c.c. of boiling water, and at once filtered through asbestos; and as soon as the whole of the residue is on the filter, it is washed successively with 300—400 c.c. of boiling water, about 50 c.c. of alcohol (about 93 per cent.), and a warmed mixture of ether and alcohol, until the filtrate is colourless. The filter is dried until the weight is constant, weighed, ignited, and again weighed; the difference between the two weights is the amount of crude fibre free from ash. Gooch crucibles of 90 c.c. capacity and 35 mm. in diameter at the bottom were employed.

An alternative method, not involving the use of an autoclave, is also given. The substance is boiled with glycerol and sulphuric acid (the quantities are as given above) in a reflux apparatus for 1 hour; when the temperature reaches 120—130°, the contents generally froth, and the flask has to be shaken a few times. The process is afterwards completed as already described.

By the above method, the pentosans are removed either completely or nearly completely (to 6·62 per cent.). Leguminous fodders seem to be freed from pentosans with greater difficulty than gramineous fodders. The method is simpler, as well as more efficacious, than the older ones. N. H. J. M.

Separation and Estimation of Acids of the Saturated Fatty Series. By Sigmund Holzmann (*Arch. Pharm.*, 1898, **236**, 409—441).—The author has prepared and studied the properties of the barium salts of the following acids: formic, acetic, propionic, butyric, isobutyric, isovaleric, hexoic, octoic, decoic, lauric, myristic, palmitic, stearic, and cerotic.

Experiments on the separation of the volatile acids are described, based on the supposition that, if a mixture of the alkali salts of several fatty acids be partially acidified with sulphuric acid and distilled, the acid of highest molecular weight passes over first, and on further acidification, the next lower acid, &c. (compare Wechsler, Abstr., 1894, i, 12, and Crossley, Trans., 1897, 580). Formic and acetic acids cannot be separated in this way, but with the higher members a partial separation is possible.

The solubility of the alkali salts of the volatile fatty acids in methylic and ethylic alcohols increases with the molecular weight, whereas amylic alcohol dissolves more sodium propionate than sodium butyrate. The salts of the lower members are not readily soluble in acetone, whereas sodium isovalerate is very soluble, and on cooling the solution no milkiness is caused, but a separation of long, glistening, prismatic needles; by this means, isovaleric can be separated from propionic, butyric, or hexoic acid.

Ethylic palmitate, prepared by heating the acid with a 3 per cent. solution of hydrogen chloride in alcohol (yield 80 per cent. of theory) melts at 24° and boils at 184·5—185·5° at 10 mm. Ethylic stearate, produced in a similar manner (yield, the same), melts at 33·5° and boils at 199—201° at 10 mm. The melting and boiling points of mixtures of these two ethylic salts are given. A. W. C.

Sulphuric Acid as a Reagent in the Analysis of Fatty Acids By Ernst Twitchell (*J. Soc. Chem. Ind.*, 1897, **16**, 1002—1004).—The saturated fatty acids (palmitic, stearic, &c.) dissolve in, but are not sulphonated by, concentrated sulphuric acid, even at 100°; on the other hand, oleic acid seems to be quantitatively sulphonated by acid of even 85 per cent., the sulphonated acid thus produced, $C_{15}H_{31}\cdot CH_2\cdot CH(SO_4H)\cdot COOH$, being practically insoluble in light petroleum, whilst the unattacked fatty acids can be dissolved out by petroleum, if acid not stronger than 85 per cent. has been employed. From 95 per cent. sulphuric acid, petroleum fails to dissolve out stearic and palmitic acids. For the examination of a mixture of saturated and unsaturated fatty acids, about 1 gram is solidified in a thin layer on the bottom of a stoppered conical flask, about 3 c.c. of 85 per cent. sulphuric acid is added, and the flask slightly warmed; as soon as a clear solution has been obtained, the flask is quickly cooled, 50 c.c. of light petroleum is added, the stopper inserted, and the flask violently shaken. The petroleum extract is then decanted, the flask twice rinsed with 10 c.c. of petroleum, and the united extracts washed with water and evaporated.

Lard yielded 42·3 per cent., two samples of cotton-seed oil 32·6 and 23·9 per cent. respectively, of saturated acids, having melting points of 53—53·5°. M. J. S.

Estimation of Tartaric Acid. By John Moszczenski (*J. Soc. Chem. Ind.*, 1898, **17**, 215—216).—Goldenberg's "acid method," which, at the present time, is almost exclusively employed, does not provide for the separation of iron, aluminium, or the pectinic substances which are present in argols and lees, and which probably interfere greatly with the final titration. The following method excludes these substances, and is shorter than Goldenberg's. Five grams of the finely pulverised substance is treated with 26 c.c. of 13 per cent. sulphuric acid; this provides a sufficient excess of sulphuric acid for all ordinary materials, a large excess should be avoided. After stirring for a few minutes, the mixture is made up to 250 c.c. with alcohol of at least 90 per cent., well shaken, immediately thrown on a ribbed filter, and 200 c.c. of the filtrate measured into a basin; any long delay at this stage is objectionable, as there is a risk of ethylic tartrate being formed. An alcoholic solution of potassium acetate is now added as long as it produces a precipitate of potassium hydrogen tartrate; also 5 c.c. of strong potassium chloride solution. After 6 hours, the precipitate is collected on a filter, washed with strong alcohol, and titrated as usual. A correction of 1·2 c.c. should be made for the bulk of the insoluble matter in the 250 c.c. flask, and 0·320 (? gram or per cent.) of tartaric acid should be added to the result to compensate for the solubility of potassium hydrogen tartrate in alcohol. The method is interfered with by the presence of potassium oxalate, as also is the case with Goldenberg's; phosphoric acid also raises the results, apparently to the extent of 1 molecule of tartaric acid for 1 molecule of P_2O_5.

M. J. S.

Estimation of Potassium Hydrogen Tartrate in Wines. By Louis Magnier de la Source (*Chem. Centr.*, 1898, i, 149; from *Rev. Intern. Falsific.*, 10, 195—196).—First method.—Ten c.c. of the wine is evaporated over sulphuric acid to dryness, and meanwhile a solution is made by dissolving 1 gram of potassium hydrogen tartrate in 100 c.c. of water containing 10—12 c.c. of alcohol, and adding an excess of pure potassium sulphate; 10 c.c. of the filtrate is then added to the wine residue, so as to dissolve all matters except the cream of tartar and any potassium sulphate which may be present. After washing the insoluble matter with the same liquid, the residue is dissolved in hot water and titrated with standard baryta water.

Second method.—One hundred c.c. of wine is mixed with 1·5 gram of potassium sulphate, and evaporated down to 15 c.c.; after the lapse of 48 hours, the crystals are collected, washed with the alcoholic liquid already described, and finally titrated with baryta.

L. de K.

Analysis of Raw Materials containing Tartaric Acid. By Joh. Schäfer (*Chem. Zeit.*, 1898, 22, 255—256; 269; and 404—405). —The first paper deals with the estimation of tartaric acid in argols, &c. To obtain correct results, Goldenberg's method, slightly modified, should be used. The original process, which is all but universally adopted, consists in heating the sample with dilute hydrochloric acid, neutralising the filtrate with excess of potassium carbonate, evaporating to a small bulk, adding acetic acid and alcohol, and finally titrating the potassium hydrogen tartrate with standard alkali. The author recommends first extracting any fatty matter by means of a mixture of alcohol and ether; after adding the acetic acid and alcohol, the mixture should not be allowed to stand overnight, but should be at once filtered. In titrating, feebly red litmus paper should be used as indicator.

The second paper is a reply to Eckstein's criticism (following abstract).

L. de K.

Analysis of Raw Materials containing Tartaric Acid. By F. Eckstein (*Chem. Zeit.*, 1898, 22, 351—352).—This is a criticism on Schäfer's article (preceding abstract). The chief point of interest is the author's condemnation of the use of red litmus paper. Violet litmus paper or azolithmin paper should be used when titrating the precipitated potassium hydrogen tartrate with standard soda. The rest of the paper is not adapted for abstraction.

L. de K.

Test for Uric Acid, and its Volumetric Estimation. By Torquato Gigli (*Chem. Zeit.*, 1898, **22**, 330—331).—The paper is a preliminary communication on a new test for, and a volumetric estimation of, uric acid; 10 c.c. of the urine, or a solution of uric acid containing about the same quantity of the acid as occurs in urine, is mixed with 10 c.c. of a 7·5 per cent. solution of ammonium molybdate, and then with 10 c.c. of normal sulphuric acid. After a few minutes, 10 c.c. of normal soda is added, which causes the precipitate to redissolve; in the presence of uric acid, a bluish liquid is obtained. N/100 solution of potassium permanganate is now added, 1 c.c. at a time, until the liquid, which first becomes green and then yellow, changes to a reddish-yellow. This is the end reaction, and if the permanganate has been checked in the same manner with a known quantity of pure uric acid, the amount in the sample is readily calculated.

The author admits that urine probably contains matters which also reduce molybdic acid, and thus count as uric acid; the chief constituent of urine, the urea, does not, however, reduce the reagent.

L. de K.

Estimation of the Iodine Number. By C. Aschman (*Chem. Zeit.*, 1898, **22**, 59; 71—72).—This is a modification of Hübl's process, the fats being measured instead of weighed, and a solution of iodine chloride used instead of the mercurial solution; 30 grams of potassium iodide is dissolved in 100 c.c. of water contained in a flask furnished with a side tube, which serves to carry off the excess of chlorine. Washed chlorine is now passed into the solution until the liberated iodine has redissolved, forming a dark yellow liquid. After being left for 6 hours in a cold place, potassium iodate and iodic acid separate. The clear liquid is then poured off, the crystals are washed four times with water, and the whole is made up to one litre. The solution is further diluted to such an extent that 10 c.c. of it, on adding 10 c.c. of a 20 per cent. solution of potassium iodide, liberates as much iodine as will correspond with 40 c.c. of N/10 sodium thiosulphate. The solution will keep unaltered for a year.

The fatty solution is made by measuring exactly 10 c.c. of the oil at 15°, or 10 c.c. of a melted fat at 50°, and dissolving this in exactly 10 c.c. of chloroform. Of this solution, 0·4 c.c. is carefully measured into a 250 c.c. flask, and after adding 10 c.c. of chloroform, 20 c.c. of the iodine chloride is introduced, the mixture is well shaken, and left for 24 hours in the dark with occasional shaking, when it is titrated with thiosulphate in the usual way, after adding 10 c.c. of 20 per cent. solution of potassium iodide.

A list of test results is given, the iodine figures being decidedly lower than those obtained by the original Hübl method. It is claimed, however, that they are more trustworthy and concordant. L. de K.

Detection of Sesame Oil in Butter or Margarines. By Paul Soltsien (*Chem. Centr.*, 1898, i, 224; from *Pharm. Zeit.*, 1897, **42**, 837; 846)—In applying the furfuraldehyde test to butter or margarine, care should be taken to use a hydrochloric acid of sp. gr. = 1·125, as the stronger acid of sp. gr. = 1·19 causes a distinct red coloration with furfuraldehyde alone, and also with turmeric, which is often used to colour butters. Fats containing sesame oil give a permanent, fine red colour when heated on a water bath with stannous chloride; the colour is not discharged by moderately diluting with water. Turmeric also gives a reddish coloration with strong hydrochloric acid or stannous chloride, but the colour is not stable and disappears on adding water. L. DE K.

Detection of Rape Oil. By A. PALAS (*L'Orosi*, 1897, **20**, 49—50).—Thirty cubic centimetres of a 0·1 per cent. solution of rosaniline are mixed with 20 c.c. of sodium hydrogen sulphite solution of 34°, 200 c.c. of water, and 5 c.c. of sulphuric acid of 65°. The reagent thus obtained, which should be perfectly colourless, is agitated in the cold with an equal volume of the oil to be tested, when a rose tint is developed if rape oil is present. Two per cent. of rape oil can be detected in olive oil by this means. The reaction is not given by other oils, neither is it given by the fatty acids of rape oil itself.

N. L.

Apparatus for the Rapid Estimation of Fat in Soap, and of Hehner's Number. By GIOVANNI POSSETTO (*L'Orosi*, 1897, **20**, 73—76).—The apparatus consists of a flask of about 200 c.c. capacity, into the ground neck of which is fitted a glass tube graduated from 0 to 40 c.c. and closed at the top with a stopper. In order to determine the fatty acids in soap, about 1 gram of the sample is introduced into the flask and dissolved in hot water. The solution is then cooled, acidified with dilute sulphuric acid, the graduated tube inserted into the neck of the flask, and sufficient water added to bring the level of the liquid to the zero mark or thereabouts. Ether is now added, and the contents of the apparatus well mixed and allowed to settle; the volume of the ethereal layer is then read, and an aliquot part of it is pipetted off and evaporated, the residue being afterwards dried and weighed. For the determination of Hehner's number (percentage of insoluble fatty acids), 1—1·5 grams of the fat or oil is placed in the flask and dissolved in alcoholic potash, the alcohol being subsequently expelled by evaporation and the residual soap treated as above described.

The apparatus is also adapted for the estimation of the amount of oil in paints, and for other purposes. N. L.

Use of Lead Dioxide as a means of Clarifying Urine for Analysis. By A. LOUBIOU (*J. Pharm.*, 1898, [vi], **8**, 270—272; from *Bull. Soc. Pharm. Bordeaux*, July, 1898).—Turbid or fermented urine can be readily clarified by the following method; to 10 c.c. of it caustic soda is added until the solution becomes alkaline to phenolphthalein, 1·0—1·5 grams of lead dioxide is then added, and the mixture well shaken during a minute, and filtered. In the clear solution thus obtained, the albumin can be determined by Tanret's reagent; experiment shows that no albumin is removed by the lead dioxide during clarification. The process described is especially useful in the case of turbid biliary urine which cannot be obtained clear by other methods. W. A. D.

Modification of Mörner and Sjöquist's Method of Estimating Urea. By HENRI MOREIGNE (*J. Pharm.*, 1898, [vi], **8**, 193—197. Compare Abstr., 1891, 758 and 1561).—The process named is more rapidly carried out by determining the nitrogen of the urea by means of sodium hypobromite, instead of by Kjeldahl's method, as originally recommended. After the process has been carried out as usual until the addition of magnesia, the solution is evaporated to 8 or 10 c.c., a little distilled water added, and the solution decanted from the magnesia; the latter is washed by decantation, and the washings added to the solution of urea, which is diluted to 50 c.c., and the urea present in 10 c.c., determined by the hypobromite method.

The above method gives lower results with urine than are obtained on purifying the latter by basic lead acetate, before estimating the urea; the difference is due to the ammonium salts not being removed in the latter process. W. A. D.

Estimation of Urea in Urine by means of Sodium Hypobromite. By Henri Moreigne (*J. Pharm.*, 1898, [vi], **8**, 197—200, and 241—245).—The results obtained by the ordinary method, using basic lead acetate to purify the urine, are too high, owing probably to the incomplete removal of ammonium salts (compare preceding abstract) and small quantities of guanine and creatinine. All the substances present in urine, including ammonium salts, which are capable of yielding nitrogen when acted on by sodium hypobromite, are, however, completely precipitated on adding phosphotungstic acid. It is important that the latter should be prepared as follows: 20 grams of sodium tungstate and 2·34 grams of crystallised phosphoric acid are boiled with 100 c.c. of water during 20 minutes, the solution slightly acidified with hydrochloric acid, and, after standing, filtered. To 10 c.c. of the urine, a small quantity of water is added, together with 4 c.c. of hydrochloric acid, and the amount of phosphotungstic acid (15—20 c.c.) necessary for accurate precipitation, and the whole diluted to 50 c.c.; after standing 24 hours, the solution is filtered, and 25 c.c. of the filtrate, rendered slightly alkaline by caustic soda, diluted to 50 c.c. The urea is estimated in 10 c.c. of the solution thus obtained by the hypobromite method.

In the case of certain pathological urines, it is advisable to subject the latter to a preliminary precipitation with basic lead acetate. After adding this and diluting the solution to a known volume, it is left for some time, filtered, and the lead precipitated in an aliquot portion by dilute sulphuric acid; any excess of the latter is neutralised with caustic soda, the solution acidified with hydrochloric acid, and the lead sulphate allowed to subside. One-half of the total volume is then filtered, precipitated with phosphotungstic acid, and the urea determined as above described. W. A. D.

Relation between the Total Nitrogen of Urine and the Nitrogen Present as Urea. By Henri Moreigne (*J. Pharm.*, 1898, [vi], **8**, 293—302).—Although the method of determining the total nitrogen of urine by Kjeldahl's process, generally adopted, is satisfactory, the methods for determining the nitrogen of the urea are by no means accurate (compare preceding abstract). If, for example, the solution to which sodium hypobromite is added, in the hypobromite method, contains more than 0·5 gram of urea in 100 c.c., an error as great as 2·5—3 per cent. may arise; the composition of the solution of hypobromite also exercises great influence on the volume of nitrogen obtained. In the author's opinion, little value can be attached to the ratio of total nitrogen of urine to urea nitrogen determined by other investigators. W. A. D.

Volumetric Estimation of Alkaloids as Higher Periodides. By Albert B. Prescott and Harry M. Gordin (*J. Amer. Chem. Soc.*, 1898, **20**, 706—728). See this vol., i, 89.

Volumetric Method for the Estimation of the Total Alkaloids in "Cortex chinæ succirubr." By H. Ekroos (*Arch. Pharm.*, 1898, **236**, 328—334).—The finely powdered bark is extracted with a mixture of chloroform, ether, and aqueous soda for 3 hours, and a certain portion of the clear ethereal solution is then shaken with normal sulphuric acid, the excess of acid being titrated back with decinormal caustic potash solution, using a freshly prepared alcoholic solution of hæmatoxylin as indicator. The end of the reaction is denoted by a pale yellow colour, which, on vigorous shaking, changes to a bluish-violet.

The method can also be used for the analysis of quinine extracts.
A. W. C.

Indigo Testing by Permanganate. By J. Grossmann (*J. Soc. Chem. Ind.*, 1897, **16**, 974—975).—It has been stated by Rawson (*J. Soc. Chem. Ind.*, 1885, 489) that, by direct titration with permanganate after sulphonation, a fairly approximate idea of the value of a sample of indigo can be formed; the author shows, however, that, although this may be true as regards high class indigoes (Bengal, Java), the method, when applied to low class samples (Kurpahs, Oudes), gives very variable results, which, in some cases, may err to the extent of 34 per cent. Results sufficiently trustworthy for practical purposes are, however, obtained if the sulphindigotic acid is precipitated by sodium chloride, and after washing is dissolved in dilute sulphuric acid and titrated. The instructions given by Rawson (not here reproduced) must be exactly followed, and they should be combined with the author's dye test, which is not described in this place.
M. J. S.

Indigotin and Nitrobenzene. By B. William Gerland (*J. Soc. Chem. Ind.*, 1897, **16**, 108—109. Compare Abstr., 1898, ii, 102).—Carefully purified cold nitrobenzene dissolves indigotin very slowly; on warming, however, a blue solution is obtained, which becomes tinged with red at 65°, and pure blood-red at 95°. On cooling, the solution remains red during several hours, but if a glass rod is introduced immediately becomes blue. Owing to the tendency to supersaturation which nitrobenzene solutions of indigotin exhibit, the solubility of the latter at the boiling point of the solvent could not be accurately determined; the numbers vary from 0·5—1 gram in 100 c.c.

After indigotin has separated from its nitrobenzene solution, 25 c.c. of the filtrate contains only 0·000225 gram of indigotin; in the author's process of determining indigotin (*loc. cit.*), this amount is quite negligible. The indigotin crystals, before weighing, should be extracted on the filter with acid and alcohol, dried, washed with benzene, and digested with concentrated hydrochloric acid; after boiling with water and with aqueous sodium carbonate, the crystals are finally thoroughly washed with water, dried, and weighed. To determine indigotin in woollen and cotton fabrics, it is best to destroy the fibre by treatment with dilute sulphuric acid, and after filtering, washing, and drying to extract the residue with nitrobenzene.

The author has confirmed the accuracy of his method by comparing the results given by the latter with those obtained by the Müller-Bernthsen method; in addition, accurate results were obtained when known weights of indigotin were suitably adulterated, and then determined by the nitrobenzene method. W. A. D.

Detection of Turmeric in Rhubarb Powder. By ADAM JAWOROWSKI (*J. Pharm.*, 1898, [vi], **8**, 303—304; from *Ann. Chim. Anal.*, 1898, 102).—If the powder contains turmeric, on agitating it with chloroform (10 c.c.) for several minutes, and filtering, a yellowish-brown solution is obtained with a greenish fluorescence; and on adding light petroleum (50 c.c.), a yellow, flocculent precipitate is formed, although the solution remains yellow and fluorescent. This is now divided into two portions; to the first, sulphuric acid (2—3 c.c.) is added, and to the second, a saturated solution of borax (1—1·5 c.c.). In presence of turmeric, the former becomes violet, whilst the acid layer, at first bright red, becomes successively reddish-brown and yellow; the borax solution becomes coloured violet, without, however, any colour-change taking place in the petroleum layer. W. A. D.

Standard Methods for the Sampling and Analysis of Tanning Materials. By HENRY R. PROCTER and J. GORDON PARKER (*J. Soc. Chem. Ind.*, 1898, **17**, 6—10).—This communication makes public the resolutions on the above subject adopted by an International Conference of the Chemists connected with the leather industry, held in London on September 28—30, 1897. The "hide powder" method was adopted for the estimation of tannin. The resolutions came into force on January 1st, 1898, and all leather trades' chemists who are members of the Association have agreed to work by the Conference methods until these are altered at a future Conference. M. J. S.

Chemical Method of Ascertaining whether Milk or Cream has been Heated to at least 80°. By V. STORCH (*Bied. Centr.*, 1898, **27**, 711—714; from 40de *Beret. kgl. Vet. Landbohöjskoles Lab. landökon. Fors. Copenhagen*, 1898, 1—16).—Not only mixed milk, but the milk of single cows during the whole period of lactation, shows a bluish-grey coloration when treated with a drop of dilute hydrogen peroxide and a few drops of a 2 per cent. solution of paraphenylenediamine. The action seems to be rather less in the case of cream and rather greater with butter milk, probably owing to the varying amount of fat globules present.

Whey produces a dark violet-brown colour. It is supposed that the blue coloration obtained with milk is the result of a special interaction of the casein and the diphenylenediamine.

Butter milk from sour cream gave the coloration only when the free acid was partly neutralised with lime water. Milk fat globules free from milk serum, and pure casein solutions, gave no coloration.

The "active substance" could not be obtained quite pure. It is especially abundant in the deposit which forms on the inner side of a centrifugal separator. When obtained as free as possible from proteids, the aqueous solution gives the same violet-brown coloration as is obtained with whey, but when added to boiled milk (which gives no coloration with hydrogen peroxide and paraphenylenediamine) the dark blue colour is at once obtained.

Milk which has been heated to 79—80° may still produce the blue coloration, provided that it is cooled as soon as that temperature is reached. Heating for 2 minutes at 75° is sufficient to destroy the "active substance" if the cooling is slow.

As regards the effect of acidity, it was found that, whilst with milk which required 17 c.c. of N/10 alkali to neutralise 100 c.c., the limit of temperature was 79°, butter milk which required 90 c.c. of alkali was rendered inactive by heating to 71°.

The reaction is not without importance in the case of Pasteurisation. It sometimes happens that the whole of the milk has not been heated to 79°. Milk heated to 82°, mixed with 10 per cent. of milk heated to 78°, showed the blue coloration distinctly. The presence of 1 per cent. of milk heated at 75° could also be detected. N. H. J. M.

Gelatin in Chocolate. By P. ONFROY (*J. Pharm.*, 1898, [vi], 8, 7—9).—In presence of 5 per cent. of gelatin, as much as 10 per cent. of water can be added to chocolate without altering the latter's appearance. When a considerable proportion of gelatin is present it can be detected by boiling the chocolate (5 grams) with water (50 c.c.), adding 5 c.c. of 10 per cent. solution of lead acetate, filtering and adding a few drops of a saturated solution of picric acid; the latter produces an immediate, light yellow, amorphous precipitate with solutions containing more than 0·01 per cent. of gelatin. When only a small quantity of gelatin is present in a chocolate, it is rendered insoluble by the tannin of the latter, and the following method has to be adopted for its detection. After removing the fat from 10 grams of the sample by means of ether, 100 c.c. of warm water is added, then 5—10 c.c. of a 10 per cent. solution of potassium carbonate, and 10 c.c. of 10 per cent. lead acetate; on filtering and carefully neutralising, a solution is obtained which can be tested for gelatin by the ordinary methods. W. A. D.

General and Physical Chemistry.

Magnet-radiometer. By Nicolae Teclu (*J. pr. Chem.*, 1898, [ii], **58**, 255—260. Compare Abstr., 1893, ii, 401).—The paper contains a detailed description and photograph of the "magnet-radiometer" designed by the author for use in the diaphonometer previously described by him (*loc. cit.*). The outer portion of the vane of a radiometer is coated with a very thin layer of iron, so that movements of the vane can be caused, not only by the action of light rays, but also by the approach of a magnet; when both forces are applied simultaneously, the position assumed by the vane will be a resultant of the two, and so can be applied to the measurement of the intensity of the light falling on the instrument. A. W. C.

Yellow Light for the Polarimeter. By François Dupont (*Bull. Soc. Chim.*, 1897, [iii], **17**, 584).—A much more satisfactory yellow light for polarimetric observations is obtained when a mixture of sodium chloride and trisodium phosphate, in molecular proportions, is used in place of sodium chloride alone. J. J. S.

Normal Elements. By Douglas McIntosh (*J. Physical Chem.*, 1898, **2**, 185—193).—The object of the author in undertaking this research was to find a convenient standard having an E.M.F. of about 0·5 volt. A cell consisting of zinc, zinc chloride, lead chloride, and lead, as described by Baille and Féry, gives good results, and has an E.M.F. of 0·5 at 20° when the specific gravity of the zinc chloride is 1·23. The temperature coefficient is extremely low. A great many cells in which mercuric oxide was used as a depolariser were tried, but none of these were satisfactory, and the use of other oxides as depolarisers gave negative results. Cells of copper, copper sulphate, mercurous sulphate, and mercury were tried and gave excellent results. The copper sulphate and mercurous sulphate are each taken in the form of a paste. The E.M.F. of this cell decreases with rising temperature, and in the neighbourhood of 16·5° may be calculated by the formula $E = 0{\cdot}3613 + (16{\cdot}5 - t)0{\cdot}0006$ volt. Cells containing Pb, $PbCl_2$, Hg_2Cl_2, Hg were also examined, and gave satisfactory results. The E.M.F. increases with the temperature, and may be calculated approximately between 15° and 21° by the formula $E = 0{\cdot}5382 + (t - 21)0{\cdot}0006$. H. C.

Determination of Polarisation. By Karl Heim (*Zeit. Elektrochem.*, 1898, **4**, 527).—In an electrolytic cell of resistance R, with insoluble anode, through which current C is passing with E.M.F. $= E$, we have $E = p + CR$, where p is the polarisation. If a thin sheet of metal be interposed between the electrodes so as to divide the cell completely, without sensibly affecting its resistance, and the current be maintained unchanged, we have $E' = 2p + CR$, or $p = E' - E$. In putting the method into practice, the main difficulty is encountered in arranging the cell so that the third electrode may be put in or taken out easily, and in such a way that the current shall pass through it, and not round it. A rectangular ebonite cell is provided with platinum electrodes fitting into grooves in the walls 60 mm. apart. Between these, a third groove, 8 mm. deep and 0·25 mm. wide, receives the third electrode. This depth is sufficient to prevent undue leakage round the electrode with moderate conductivities and current densities. A greater depth would be better. About half an hour elapses before the polarisation becomes constant. The following are some of the results obtained.

Copper sulphate, 16 per cent. at 14·7—14·95°.

Current density...	0·03	0·06	0·12	0·2	0·3	amp./sq. dcm.
Polarisation	1·591	1·628	1·668	1·695	1·717	volts.

Silver nitrate, about normal, at 15—15·5°

Current density...	0·015	0·03	0·06	0·12	0·2	0·4	amp./sq. dcm.
Polarisation	0·888	0·897	0·903	0·908	0·926	0·935	volt.

T. E.

Pulverisation of Metal Cathodes During Electrolysis with a Constant Current. By Georg Bredig and Fritz Haber (*Ber.*, 1898, 31, 2741—2752. Compare Abstr., 1898, ii, 364).—When a cathode consisting of a bright lead plate or wire conveying a current at 24—72 volts is brought into dilute sulphuric acid, a platinum anode being employed, a momentary pulverisation of the lead occurs, and a fine, metallic powder falls through the liquid. This takes place at isolated spots on the surface of the metal, bright indentations being left with rounded edges. A similar phenomenon takes place in alkaline solutions, but in this case is continuous and much more energetic. The metallic lead thrown down is peculiarly susceptible to chemical change, and can readily be converted into white lead by the simultaneous action of air and carbonic anhydride. The addition of small quantities of a chromate or chromium salt prevents the occurrence of the phenomenon. Mercury, tin, bismuth, thallium, arsenic, antimony, and Rose's metal all show the same phenomenon in alkaline solutions, whereas cadmium, zinc, copper, silver, aluminium, platinum, and palladium do not act in this way. In acid solution, on the other hand, only bismuth and Rose's metal behave in a similar manner to lead. The phenomenon is to be distinguished from the loosening of the surface which occurs with cathodes of platinum, palladium, and lead. In alkaline solution, it is probably preceded by the formation of an alloy of the metal of the cathode with the alkali metal present, which is then decomposed by the water. This is especially marked in the case of mercury, but no similar action can occur in acid solution. A. H.

Electrolytic Decomposition of Aqueous Solutions. By L. Glaser (*Zeit. Elektrochem.*, 1898, 4, 355, 373, 397, and 424).—The author first repeats the experiments of Smale (Abstr., 1894, ii, 436) on the oxygen-hydrogen gas cell, and confirms his conclusion that the formation of water in this cell takes place in a reversible way at the E.M.F. of 1·08 volts. He then goes on to determine the E.M.F.'s required to separate the ions contained in various aqueous solutions from their electrical charges. The observations are made by applying any desired

E.M.F. from zero upwards to a pair of electrodes immersed in the solution under examination, and noting the current which is thereby caused to pass through the cell. When the E.M.F. is less than that required to produce continuous decomposition, a very small diffusion current is observed. When the decomposition point is reached, the current increases more or less suddenly, so that at each decomposition point a change in the direction of the curve connecting current and E.M.F. is observed. One of the electrodes is made of platinised platinum saturated with atmospheric oxygen, and is very large compared with the other; in this way, its polarisation is rendered practically constant and the changes of direction observed are due to separation of ions at the small electrode.

The small electrode being used as cathode, a decided increase of current is found at 1·08 volts with dilute sulphuric acid, and a much less decided change at the same E.M.F. with solutions of sodium or potassium hydroxide; the difference is due to the small number of hydrogen ions in the solutions of the bases. In all cases, a decomposition point is better marked the greater the quantity of the particular ion which is present.

When the small electrode was used as anode and the large oxygen electrode as cathode, an exceedingly well marked decomposition point was found at 0·59 volt with solutions of sodium or potassium hydroxides, and a much less marked decomposition point at 0·6 volt with dilute sulphuric acid.

The ion separated here is, therefore, hydroxyl. Measured in both cases with reference to the large oxygen electrode, 1·08 volts are therefore required for the continuous separation of hydrogen and 0·59 volt for that of hydroxyl. The sum of these quantities, 1·67 volts, is the frequently observed polarisation in the ordinary electrolysis of dilute aqueous solutions. That visible electrolysis can be produced with 1·08 volts is explained by assuming the separation of $\overset{--}{\mathrm{O}}$ ions, the very minute amount of these ions present accounting for the slow course of the decomposition.

When a solution of potassium hydroxide is electrolysed, using the small electrode as cathode, two changes of direction are observed in the current-E.M.F. curve. The first, at 1·08 volts, corresponds with the separation of the hydrogen ions from their charges, whilst the second corresponds to the separation of potassium ions. The position of the second point varies with the concentration of the potash solutions, the following values being found: 10N, 1·32 volts; 4N, 1·38 volts; 1N, 1·4 volts; $\frac{1}{8}$N, 1·45 volts; $\frac{1}{80}$N, 1·46 volts. Similar results are obtained with other bases, the values being,

1	normal	KOH	1·4	volts
1	„	NaOH	1·315	„
0·0002	„	$Mg(OH)_2$	1·395	„
0·02	„	$Ca(OH)_2$	1·33	„
0·22	„	$Ba(OH)_2$	1·185	„
0·063	„	$Sr(OH)_2$	1·20	„

From the latter measurements, it follows that the separation of hydrogen from aqueous solutions is only primary with very small electromotive forces; with any ordinary current, the greater part of it is due to secondary action. T. E.

Thermochemistry of Suberic Acid. By GUSTAVE MASSOL (*Bull. Soc. Chim.*, 1897, [iii], 17, 745—746).—Suberic acid crystallises in brilliant, white scales melting at 139·5°; one litre of water at 17° dissolves about 1·8 grams of the acid, the heat of dissolution being −5·45 Cal. Normal potassium suberate becomes anhydrous at 100°, and dissolves in water with the development of +0·92 Cal. Potassium hydrogen suberate is only very slightly soluble in cold water; its heat of dissolution is −5·26 Cal. at 40°. When a solution of this salt is concentrated on the water-bath, suberic acid first crystallises out, and then the acid salt, whilst the more soluble normal salt remains in solution. From the heats of neutralisation,

$$C_8H_{14}O_4(\text{solid}) + 2KOH(\text{diss.}) = C_8H_{12}K_2O_4(\text{diss.}) + 17{\cdot}9 \text{ Cal.}$$
$$C_8H_{13}KO_4(\text{diss.}) + KOH(\text{diss.}) = C_8H_{12}K_2O_4(\text{diss.}) + 11{\cdot}4 \text{ Cal.}$$

it is calculated that the heats of formation of normal potassium suberate and potassium hydrogen suberate are +44·76 Cal. and +25·67 Cal. respectively, all the substances concerned being in the solid state.

N. L.

Thermochemistry of Sebacic Acid. By GUSTAVE MASSOL (*Bull. Soc. Chim.*, 1897, [iii], 17, 746—747).—Sebacic acid crystallises in anhydrous, nacreous scales melting at 129°. One litre of water at 16° dissolves 0·55 gram of the acid, without sensible development of heat. Normal potassium sebate crystallises with one molecule of water, and dissolves in water with the absorption of −1·33 Cal.; it does not lose water at 100°, nor when placed in a vacuum over sulphuric acid, but the anhydrous salt is obtained by heating at 150° in a current of dry hydrogen. Its heat of dissolution is +1·47 Cal. From the heat of neutralisation,

$$C_{10}H_{18}O_4(\text{solid}) + 2KOH(\text{diss.}) = C_{10}H_{16}K_2O_4(\text{diss.}) + 17{\cdot}68 \text{ Cal.},$$

it is calculated that the heat of formation of normal potassium sebate is 43·99 Cal., all the substances concerned being in the solid state.

Potassium and sodium hydrogen sebates are not sufficiently soluble in water to allow of thermochemical study by the usual methods.

N. L.

Normal Dibasic Acids of the Oxalic Series. By GUSTAVE MASSOL (*Bull. Soc. Chim.*, 1897, [iii], 17, 747—748).—The heats of formation of the anhydrous normal potassium salts of some acids of the oxalic series have been found to be as follows: oxalic acid, +58·97 Cal.; malonic acid, +48·57 Cal.; succinic acid, +46·40 Cal.; glutaric acid, + 44·23 Cal.; suberic acid, +44·76 Cal.; sebacic acid, +43·99 Cal. From these results, it appears that, as the molecular weight of the acid and the distance between the two carboxyl groups increase, the heat of formation of the salt decreases, and ultimately approaches that of two molecules of potassium acetate (43·72 Cal.). The influence of the carboxyl groups on each other decreases rapidly with the introduction of intermediary CH_2-groups, a fact which is in accordance with the formation of anhydrides from these acids, succinic anhydride being easily obtained and glutaric anhydride with difficulty, whilst the higher members of the series seem to be incapable of existence. A similar relationship is observed in the production of lactones from acids of the lactic series. N. L.

Acetaldoxime. By HECTOR R. CARVETH (*J. Physical Chem.*, 1898, **2**, 159—167).—The author has repeated Dunstan and Dymond's experiments on the freezing point of acetaldoxime (Trans., 1892, **61**, 471; 1894, **65**, 206), and confirmed them in every detail. All the freezing point phenomena can be accounted for on the assumption of an equilibrium between two modifications in the liquid phase. Although the rate of change of the freezing point of acetaldoxime is a function of the temperature to which the substance is heated, the final equilibrium is independent of the temperature. Heating to 114·5° causes the freezing point to drop from 47° to 13°, and also if the crystals are kept long enough at 20° they will liquefy, and if the liquid is kept for about 10 days and then cooled, the freezing point will be found to be 13°. In other words, the equilibrium is not displaced by the temperature, and the relative amounts of these two modifications is not a function of the temperature. The liquefaction of the crystals is not accompanied by a measurable change of vapour pressure, and the author regards it as probable that two modifications exist in the vapour. Sunlight does not produce any visible effect.

H. C.

Determination of the Specific Gravity of Pulverulent Substances. By GUSTAV J. W. BREMER (*Rec. Trav. Chim.*, 1898, **17**, 263—269).—By the following method, more accurate results can be obtained than by using Kopp's volumenometer, and small quantities only of the substance dealt with are necessary; the difficulty of removing air bubbles in the ordinary method, using a pyknometer, is also obviated. A flask (*F*), having a capacity of from 3—15 c.c., is surrounded by cold water, and is connected to a three-way stop-cock (*R*) fitted to the top of a manometer tube (*a*) which is closed below by an ordinary tap, *S*, through which it communicates by india-rubber tubing with a pressure tube (*C*), *R* enables the flask *F* to be in connection with the manometer tube alone or with both it and the air simultaneously. The pressure tube is filled with mercury; by raising *C*, the level of the mercury in *a* is brought to coincidence, under atmospheric pressure, *H*, with the upper edge (*p*) of a window in a ring which slides on *a* near the top. By turning *R* through 180°, the connection between the flask and the air is broken, and the tube *c* is then lowered until the level of the mercury in *a* coincides with the upper edge (*q*) of the window in a second ring placed near the bottom of *a*. The difference in level, *h*, of the mercury in the tubes *a* and *c* is measured by a cathetometer.

The observations described are then repeated after introducing a weighed amount, *w*, of the substance taken into the flask *F*. If *h'* denote the new difference of level in the tubes *a* and *c*, corresponding to the original *h*; *H'* the atmospheric pressure during the latter part of the experiment, *v* the volume occupied by the mercury between the levels of the upper edges of the windows *p* and *q*, and *a* the required volume of the powder, then $x=v\left(\frac{H}{h}-\frac{H'}{h'}\right)$. If, as is usual, $H=H'$, $x=vH\left(\frac{h'-h}{hh'}\right)$; and the required density $d=\frac{whh'}{vH(h'-h)}$. Since the accuracy of the method is a maximum when $v=\sqrt{VV'}$, V denoting the volume of the flask F and of the tubes connecting it with the manometer, as far as the upper level of the window p, and V' the volume $V-x$, the ring p is moved, before carrying out the experiment, into such a position that $v=\sqrt{VV'}$, approximately. Care is taken throughout that the temperature of the flask F is kept constant.

W. A. D.

Vapour Tension of Concentrated Hydrochloric Acid Solutions. By F. B. Allan (*J. Physical Chem.*, 1898, **2**. 120—124).—If the action of hydrogen chloride on water resulted only in the electrolytic dissociation of the hydrogen chloride, the relation between the undissociated molecules in a given volume of the solution and the pressure of the gas should be a constant. Vapour pressure measurements were made by forcing air through hydrogen chloride solutions, absorbing the vaporised gas in water in Liebig bulbs, and titrating with a potash solution. The vapour pressures of the solutions examined were found to be as follows.

°/₀ HCl.	Pressure in mm.	°/₀ HCl.	Pressure in mm.	°/₀ HCl.	Pressure in mm.
36·40	138·1	34·85	66·6	31·75	21·9
35·90	109·8	33·90	46·0	30·20	11·8
35·10	75·8	32·85	32·7	28·10	5·5

The above readings give a very regular curve. If the vapour tension is taken as proportional to the undissociated hydrogen chloride, the degree of dissociation in a 28·1 per cent. acid is 94·8. This is an impossible value for so concentrated a solution, and it is concluded, therefore, that electrolytic dissociation is not an adequate explanation of the fact that hydrochloric acid solutions do not obey Henry's law.

H. C.

Naphthalene and Aqueous Acetone. By Hamilton P. Cady (*J. Physical Chem.*, 1898, 2, 168—170).—Mixtures were made of acetone and water, and naphthalene in excess added to each solution, and the temperatures determined at which a second liquid phase first appeared. The temperatures at which different solutions begin to separate into two layers in presence of solid naphthalene, and the compositions of these solutions, are as follows.

Acetone.	Water.	Naphthalene.	Temperature.
10·00	89·92	0·08	65·5°
19·91	80·00	0·09	55·3
29·92	69·67	0·41	45·0
40·81	58·22	0·97	38·0
48·67	48·68	2·65	32·2
57·43	36·64	5·93	28·5
60·43	25·75	13·82	28·2

The effect of a very small quantity of naphthalene on the consolute temperature is very marked.

H. C.

Distribution of Mercuric Chloride between Toluene and Water. By Oliver W. Brown (*J. Physical Chem.*, 1898, **2**, 51—52).—According to Skinner (Trans., 1892, **61**, 342), a fairly constant distribution ratio is obtained when mercuric chloride is added to mixtures of ether and water. Experiments made by the author with toluene and water show that the ratio of the concentrations is not constant in this case, the concentrations in the water phase not increasing quite so rapidly as those in the toluene phase. This would mean, according to the Nernst theory, that there is a slight dissociation in the aqueous solution. H. C.

Solubilities of some Sparingly Soluble Liquids in Water. By W. Herz (*Ber.*, 1898, **31**, 2669—2672).—The author has determined the mutual solubility of a number of liquids and water, with the following results.

1000 c.c.	of water	dissolve	4·20	c.c.	of chloroform,	forming	1003·9	c.c. of solution.
,,	,,	,,	1·74	,,	carbon bisulphide,	forming	1002·08	,,
,,	,,	,,	3·41	,,	light petroleum (sp. gr. 0·6646)	,,	1003·41	,,
,,	,,	,,	81·10	,,	ether	,,	1071·45	,,
,,	,,	,,	0·82	,,	benzene	,,	1000·82	,
,,	,,	,,	32·84	,,	amylic alcohol	,,	1029·92	,,
,,	,,	,,	34·81	,,	aniline	,,	1034·81	,,
,,	chloroform	dissolve	1·52	,,	water	,,	996·2	,,
,,	carbon bisulphide	dissolve	9·61	,,	,,	,,	1009·61	,,
,,	light petroleum	dissolve	3·35	,,	,,	,,	1006·04	,,
,,	ether	,,	29·30	,,	,,	,,	1032·82	,,
,,	benzene	,,	2·11	,,	,,	,,	1001·35	,,
,,	amylic alcohol	dissolve	22·14	,,	,,	,,	1012·82	,,
,,	aniline	,,	52·22	,,	,,	,,	1049·55	,,

A. H.

Indicators. By John Waddell (*J. Physical Chem.*, 1898, **2**, 171—184).—According to the dissociation theory, an indicator must be a weak base or a weak acid in which one of the ions has a different colour from that of the undissociated substance. Under these circumstances, the presence in the solution of a liquid in which the indicator dissociates to a less extent than in water should cause the colour due to the ion to disappear more or less. Nine indicators were, therefore, taken, and tested in presence of alcohol, acetone, ether, benzene, and chloroform. The results obtained were in keeping with the dissociation theory. In alcohol and acetone, the colour of the ion is often perceptible, but this disappears when any one of the other organic solvents is added. It is often possible to predict the acid or basic properties of an indicator from the colour changes on the addition of organic solvents. Methyl-orange and lacmoid act as weak bases; fluorescein, phenacetolin, and probably corallin are both basic and acid. More satisfactory results were obtained with ammonia and acetic acid than with caustic potash and hydrochloric acid. This the author regards as due to the dissociation, to some extent, of salts of weak acids and weak bases into the free acid and free base in organic solvents. H. C.

Fractional Crystallisation. By Charles A. Soch (*J. Physical Chem.*, 1898, **2**, 43—50).—Solubility determinations of the pairs of salts, potassium chloride and potassium nitrate, potassium chloride and sodium chloride, potassium nitrate and sodium chloride, and sodium nitrate and sodium chloride were made at 25° and at 80° in pure water, and at 25° in 40 per cent. aqueous alcohol. The results are given in the following table, the concentrations being in grams of salt per hundred grams of solvent.

	Aqueous alcohol at 25°.	Water at 25°.	Water at 80°.
KCl	10·06	34·12	40·20
KNO_3	5·29	22·58	117·5
Ratio	1·90	1·51	0·361
$NaNO_3$	22·78	43·66	121·6
NaCl	10·17	26·58	17·62
Ratio	2·24	1·64	6·90
KNO_3	13·74	41·14	168·8
NaCl	15·78	38·53	39·81
Ratio	0·87	1·07	4·14
NaCl	12·28	29·05	26·5
KCl	5·87	17·1	31·0
Ratio	2·09	1·70	0·855

From the above, it will be seen that the displacement of the equilibrium by the addition of alcohol is in no case as large as the change produced by difference of temperature. A short theoretical treatment of the subject of fractional crystallisation by Bancroft is added.

H. C.

Absorption. By Jacobus M. van Bemmelen (*Zeit. anorg. Chem.*, 1898, **18**, 98—146).—The continuation of the author's research is in accordance with the previous results (Abstr., 1897, ii, 137, and this vol., ii, 12). The elimination of water from the hydrogel, up to a certain point, takes place without the formation of water-free interstices, the decrease in volume corresponding with the amount of water evaporated. The greater part of the water evaporates at 15°, with a rapidity little less than that of water itself. As the remaining water evaporates at a steadily increasing vapour pressure, the colloid gradually assumes a solid, glassy condition. The point at which the elimination of water ceases, under a given vapour pressure, varies with the method of formation and age of the colloid, the rapidity of the evaporation, and temperature. In the reabsorption of water by a partially dried colloid, a higher vapour pressure is necessary in order to obtain the same amount of water in the colloid as was present before drying. The absorbing properties of the colloid are decreased by formation in a concentrated silica solution, by prolonged drying, and by time. At a red heat, the absorbing properties are lost.

E. C. R.

General Problem of Chemical Statics. By PIERRE DUHEM (*J. Physical Chem.*, 1898, **2**, 1—42 and 91—115).—A mathematical paper not suitable for abstracting. H. C.

Combination of Gases. By H. HÉLIER (*Ann. Phys. Chim.*, 1897, [vii], **10**, 521—556).—The author describes the furnace, pyrometer, and gas apparatus employed by him in studying the combination of gaseous mixtures at definite temperatures. Experiments, made on a mixture of hydrogen and oxygen containing the gases in combining proportions, show that at any given temperature there is a certain limit of combination, and that, after a certain time, continued heating produces no further interaction. This limit is reached in a relatively short time; in the case of oxygen and hydrogen heated to 300°, the time required is 17 seconds. The amount of water produced varies with the temperature, at 180° it is only 0·04 per cent., at 825° it is 96·1 per cent., and combination takes place explosively at 853° (Abstr., 1896, i, 416). This temperature of explosion is 300° above that indicated by Mallard and Le Chatelier. Van't Hoff defined the temperature of explosion as that at which the initial loss of heat due to conduction, &c., is equal to the heat produced in the same time by the chemical reaction. It may, therefore, be raised considerably by increasing the initial loss of heat of the gaseous mixture.

Experiments made on the above mixture in the presence of nitrogen, show that the inert gas hinders the combination; at 491°, the decrease produced by the addition of $1\frac{1}{3}$ volumes of nitrogen is 17·4 per cent. Half the quantity of nitrogen produces approximately half this diminution. Excess of oxygen or hydrogen increases the amount of combination, but, volume for volume, excess of oxygen produces greater effect than excess of hydrogen.

A mixture of carbonic oxide and oxygen, in combining proportions, begins to react at 195°, the amount of combination increases slowly up to 500°, and more rapidly up to 855°, when it amounts to 65 per cent.

The presence of nitrogen diminishes the amount of combination. The inert gas also decreases the velocity of combination; with the normal mixture of carbonic oxide and oxygen at 549°, the limit is reached in 30 seconds; in the presence of $1\frac{1}{3}$ volumes of nitrogen, the limit is attained only after 70 seconds.

An excess of oxygen increases the percentage of combination, excess of carbonic oxide, on the contrary, diminishes the amount of carbonic anhydride produced. The walls of the vessels in which gaseous combination occurs have a marked influence on the results (compare Abstr., 1897, ii, 437, 486, and 548).

The combination of hydrogen and oxygen is always complete when the normal mixture is heated for 5 hours in tubes of potash glass, and the water produced is strongly alkaline; in tubes of lead glass, the combination, carried out under similar conditions, is far less complete, and some of the hydrogen is used up in reducing the lead silicate present. In new silvered tubes, the combination is complete, but on repeating the experiment the amount of water formed, although variable, never indicates complete combination.

The presence of water vapour decreases the amount of combination.

This cannot be due to the fact that there is any tendency towards a reverse action, since the effect is well marked at temperatures far below that at which steam dissociates. The combination of gases at any temperature attains a limit, not because the reaction is reversible, but because the presence of the products of combination appears to hinder the completion of the reaction. G. T. M.

Report of the Committee of the German Chemical Society on Atomic Weights. By the Members of the Committee: Hans Landolt, Wilhelm Ostwald, and Karl Seubert (*Ber.*, 1898, **31**, 2761—2768).—This report is issued by the committee appointed by the German Chemical Society on December 1, 1897, to consider the question of atomic weights, and to draw up a table of the most probable values of these constants for general use. The members of the committee were unanimous in adopting the two following conclusions.

I. The atomic weight of oxygen shall be taken as the standard, and assigned the value 16·000; the atomic weights of the other elements to be then calculated from their, directly or indirectly determined, combining proportions with oxygen.

II. The numbers which may at present be taken for practical purposes to represent the probable atomic weights of the elements are as follows.

Aluminium	Al	27·1
Antimony	Sb	120
Argon (?)	A	40
Arsenic	As	75
Barium	Ba	137·4
Beryllium	Be	9·1
Bismuth	Bi	208·5*
Boron	B	11
Bromine	Br	79·96
Cadmium	Cd	112
Cæsium	Cs	133
Calcium	Ca	40
Carbon	C	12·00
Cerium	Ce	140
Chlorine	Cl	35·45
Chromium	Cr	52·1
Cobalt	Co	59
Copper	Cu	63·6
Erbium (?)	Er	166
Fluorine	F	19
Gallium	Ga	70
Germanium	Ge	72
Gold	Au	197·2
Helium (?)	He	4
Hydrogen	H	1·01
Indium	In	114
Iodine	I	126·85
Iridium	Ir	193·0
Iron	Fe	56·0
Lanthanum	La	138
Lead	Pb	206·9
Lithium	Li	7·03
Magnesium	Mg	24·36
Manganese	Mn	55·0
Mercury	Hg	200·3
Molybdenum	Mo	96·0
Neodymium (?)	Nd	144
Nickel	Ni	58·7*
Niobium	Nb	94
Nitrogen	N	14·04
Osmium	Os	191
Oxygen	O	16·00
Palladium	Pd	106
Phosphorus	P	31·0
Platinum	Pt	194·8
Potassium	K	39·15
Praseodymium (?)	Pr	140
Rhodium	Rh	103·0
Rubidium	Rb	85·4
Ruthenium	Ru	101·7
Samarium (?)	Sa	150
Scandium	Sc	44·1
Selenium	Se	79·1
Silicon	Si	28·4
Silver	Ag	107·93
Sodium	Na	23·05
Strontium	Sr	87·6
Sulphur	S	32·06
Tantalum	Ta	183
Tellurium	Te	127
Thallium	Tl	204·1
Thorium	Th	232
Tin	Sn	118·5*
Titanium	Ti	48·1
Tungsten	W	184
Uranium	U	239·5
Vanadium	V	51·2
Ytterbium	Yb	173
Yttrium	Y	89
Zinc	Zn	65·4
Zirconium	Zr	90·6

The numbers in the above table may be regarded as correct to the last figure given, with the exception of those marked by an asterisk. The atomic weight of nickel is certainly lower than that of cobalt, but the number 58·7 is only correct to ± 0·2. A like uncertainty holds for bismuth and tin. For hydrogen, the value 1·008 is only certain to 0·001. For practical purposes, the number 1·01 may, therefore, be taken, the error being only about one-fifth per cent.

H. C.

Gas Generator. By EMIL JÄGER (*Zeit. angw. Chem.*, 1898, 961).—The apparatus, of which a drawing is given in the paper, consists essentially of a kind of large wine-glass, but having perforations through the bottom, containing the substance to be acted on and placed at the bottom of a cylindrical glass vessel containing acid. Over it is placed a double bell-jar; the inner smaller one which plays the part of a diving bell may be lifted up and down by means of a glass rod attached to it. When down, the acid is completely excluded, when up, the acid ascends and acts on the substance. The strength of the gaseous current is regulated by a screw-clamp attached to a piece of india-rubber connected with a side tube belonging to the outer bell-jar.

The advantage claimed is that, when out of use, not the slightest evolution of gas takes place, even when the screw-clamp is loosened.

L. DE K.

Inorganic Chemistry.

Quantitative Synthesis of Water. By EDWARD H. KEISER (*Amer. Chem. J.*, 1898, 20, 733—739. Compare Abstr., 1887, 1078; 1891, 1154).—By the following method, the quantities of hydrogen and oxygen combining to form water can be determined gravimetrically without the necessity of gasometric measurement. A light glass cylinder, terminated at the bottom by a narrow tube carrying a glass stopcock, and closed at the top with a round glass cap with a three-way stopcock, is divided by a slight constriction into two compartments, the smaller and lower of which contains purified phosphoric anhydride. After completely exhausting the tube, it is weighed, and pure spongy palladium, contained in a thin glass tube having a number of small holes near the bottom, is introduced into the larger compartment; the tube is again exhausted and weighed; pure hydrogen is admitted so as to completely saturate the palladium, and after partially exhausting, the amount of hydrogen absorbed is determined. Pure oxygen is then passed through the apparatus at such a rate that the water formed is completely absorbed by the anhydride, and the temperature does not rise sensibly. After completely oxidising the hydrogen, the excess of oxygen is removed by exhausting the apparatus, and the weight of the water formed is determined.

In the author's experiments, the tube used was counterpoised during all weighings by a duplicate; both the oxygen and hydrogen were prepared electrolytically, and were purified by being passed over heated palladium, and subsequently through tubes of fused caustic potash and phosphoric anhydride. The average of four experiments carried out by this method, ranging from 15·874—15·886, gives 15·880 as the atomic weight of oxygen. W. A. D.

Electrolytic Production of Chlorates, Bromates, Iodates, and Hypochlorites. By WILHELM VAUBEL (*Chem. Zeit.*, 1898, **22**, 331).—The author finds, on employing an electrolytic cell containing a saturated solution of sodium hydrogen carbonate surrounding the anode, and separated by a porous diaphragm from a strong brine solution in contact with the cathode, that the whole of the chlorine migrating into the anodic compartment is oxidised to chlorate, whilst carbonic anhydride and caustic soda are obtained at the anode and cathode respectively.

The temperature is maintained at 60—70° during electrolysis, and a current density of 5—10 ampères per sq. dcm. and an E.M.F. of 4—5 volts are employed.

A table showing the yield of chlorate after the expiration of certain ampère-hours is given, and the author compares his results with those of previous investigators.

The experimental conditions for the production of potassium chlorate are quite similar, as are also those for the preparation of bromates and iodates. When the above electrolysis is performed at lower temperatures, hypochlorite, and not chlorate, becomes the chief product, but, as in the former experiment, there is no formation of chloride round the anode. G. T. M.

Electrolytic Preparation of Perchloric Acid and its Salts. By FRITZ FOERSTER (*Zeit. Elektrochem.*, 1898, **4**, 386).—Potassium chlorate in neutral or alkaline solution is scarcely reduced by a high cathodic current density when the cathode is made of platinum, lead, copper, zinc, or nickel, but is vigorously reduced when it is of iron and to some extent when it is of cobalt. In neutral or acid solutions, chlorates are readily oxidised at the anode to perchlorates. A series of experiments shows that, with high current density, concentrated solutions, and low temperatures, the yield of perchlorate is a very good one. A 50 per cent. solution of sodium chlorate was electrolysed with equal platinum electrodes 1·5 cm. apart and a current density of 8·3 ampères per sq. dcm. The solution was at the ordinary temperature, and 4·5 volts were required. The yield increased from 86 to 98 per cent. of the theoretical amount, falling off only when the greater part of the chlorate was oxidised.

With a 5·6 per cent. solution of potassium chlorate and 8 ampères per sq. dcm. the yield was about 82 per cent., but fell off considerably when about one-half of the chlorate was oxidised. In alkaline solutions, oxidation is observed at the beginning of the electrolysis, but even with high current densities it soon ceases, so that the direct production of perchlorates from chlorides would appear to be impracticable. T. E.

Electrolysis of Solutions of Calcium Chloride. By H. Bischoff and Fritz Foerster (*Zeit Elektrochem.*, 1898, 4, 464).—Oettel's statement that a better yield of chlorate is obtained in the electrolysis of calcium chloride than in that of potassium chloride is confirmed. Measurements of the gases evolved during the electrolysis give the percentages of the current employed (*a*) in the formation of hypochlorite, chlorate, and perchlorate, (*b*) in reducing hypochlorite at the cathode, (*c*) in decomposing water. When a solution of 74·3 grams of calcium chloride in 500 c.c. of water is electrolysed with 6·7 volts, and current densities of 9·1 ampères per sq. dcm. at the anode and 13 ampères per sq. dcm. at the cathode, 85·7 to 90·4 per cent. of the current yields oxygen compounds of chlorine, mainly chlorate, 1·4 to 2·9 per cent. reduces hypochlorite, and 7·8 to 12·8 per cent. decomposes water. With a solution of 100 grams of potassium chloride + 7·5 grams of potash in 500 c.c. of water, the E.M.F. being 4·8 volts and the current densities the same as before, the corresponding values were 50·9 to 61·9, 12 to 19·9 and 20·8 to 29·6. Both solutions were cooled with ice. A solution of barium chloride gave results very similar to those obtained with potassium chloride. The small reduction observed with calcium chloride is probably due to a layer of calcium hydroxide on the cathode which acts as a diaphragm; the greater part of the calcium hydroxide formed combines with chlorine, but part of it remains undissolved, free hypochlorous acid existing in the solution and volatilising with the gases evolved. Further experiments show that at 20—25° the best yield of chlorate is obtained from solutions containing at least (preferably much more than) 10 per cent. of calcium chloride, and with a current density of 10 ampères per sq. dcm. at the anode and at least double that amount at the cathode; the yield is nearly 90 per cent. The deposit of calcium hydroxide on the cathode considerably increases the E.M.F. required; at 50°, however, 4·55 volts suffice, and the yield is but slightly reduced (80 to 87 per cent.). Determinations of oxygen in admixture with hydrogen should not be made in the phosphorus pipette, but by means of copper in presence of a solution of ammonia. T. E.

Density and Molecular Weight of Ozone. By Albert Ladenburg (*Ber.*, 1898, 31, 2830—2831. Compare this vol., ii, 18).—The calculation of the amount of ozone present in the gas employed in the experiments previously described was based on the assumption that 253·06 parts of iodine are liberated by 48 parts of ozone. Since the object of the experiment was to determine the molecular weight of ozone, the author has recalculated the results on the simpler assumption that 1 molecule of iodine is set free by 1 molecule of ozone. He thus finds that the gas employed contained 84·4 per cent. by weight of ozone, and that the density of ozone is 1·469. A. H.

Colour of Sulphur Vapour. By J. Lewis Howe and S. G. Hamner (*J. Amer. Chem. Soc.*, 1898, 20, 757—759).—The authors, after referring to the varying statements with regard to the colour of sulphur vapour, describe experiments which show that this colour varies with the temperature, being orange-yellow just above the boiling point of sulphur, becoming rapidly darker with rise of temperature until it becomes deep red comparable to the red of ferric thiocyanate; this red colour is most intense at about 500°. Above this temperature, the colour becomes lighter until at 634°, the limit of temperature at which observations were made, the colour is straw-yellow.

G. W. F. H.

The Change in Sulphur by Heat. By **Friedrich W. Küster** (*Zeit. anorg. Chem.*, 1898, **18**, 365—370).—The author has determined the amount of insoluble sulphur which is formed on heating sulphur at known temperatures for a known time. The sulphur, previously crystallised from carbon bisulphide, is sealed up in a vacuum in a glass tube, and, after heating, the insoluble portion is determined by extraction with carbon bisulphide (so-called insoluble sulphur is slightly soluble in carbon bisulphide). When heated at 141·7°, about 5·2 per cent. of insoluble sulphur is formed, the amount formed being independent of the time; after 1 hour, this amount is approximately the same as after 16 hours. When heated at 183°, the amount of insoluble sulphur is also independent of the time, and also apparently of the temperature, since about 6 per cent. of insoluble sulphur was obtained. When heated at 448° for 15 minutes and then gradually cooled, 1·8 to 3·3 per cent. of insoluble sulphur is formed; when, however, the molten sulphur is suddenly cooled by plunging into cold water, 30·9 to 34·2 per cent. of insoluble is obtained. The formation of the insoluble modification and the converse formation of soluble sulphur take place, therefore, with extreme rapidity, so that the amount of insoluble sulphur which is present after crystallisation is not dependent on the temperature and time of the heating, but on the rate of the crystallisation and the temperature at which it takes place. Therefore, different samples of sulphur which have been heated for different times above the melting point after remaining some time at a lower temperature (100°), are practically identical as regards the concentration of the insoluble modification, from which it follows that the difference observed in the velocity of solidification, &c., must be assigned to some other cause than the different concentration of the insoluble modification (Abstr., 1897, ii, 439).

A sample of insoluble sulphur which has been kept for 5 months, when treated with carbon bisulphide, gives the same percentage of soluble matter as when freshly prepared. On evaporating the solution, the sulphur separates in solid drops which show no signs of crystallisation under the microscope, but give evidence of crystallisation when subjected to polarised light. This sulphur is not completely soluble in carbon bisulphide, so that the "insoluble" modification, when dissolved, is not completely converted into the soluble modification. The author concludes that the soluble and insoluble modifications have different molecules in solution, that they are not only physical isomerides, but chemical isomerides, having a relation to each other similar to that of ozone to oxygen.

E. C. R.

Azoimide. By **Theodor Curtius** and **Johannes Rissom** (*J. pr. Chem.*, 1898, [ii], **58**, 261—309. Compare Abstr., 1891, 57; 1892, 112).—The azoimide, HN_3, was obtained in aqueous solution by distilling with dilute sulphuric acid either the ammonium salt (Abstr., 1892, 113) or the lead salt precipitated from the mother liquor of that salt; excess of acid should be avoided, especially in the latter case. Azoimide is decomposed but very slowly when boiled with dilute hydrochloric acid; most of the nitrogen is liberated as the gas; a little ammonia is formed, but neither hydroxylamine nor hydrazine. In aqueous solution at the ordinary temperature, azoimide is very stable; such loss of strength as does occur is due to volatilisation.

The metallic salts (azoimides, azides, or nitrides) were prepared (1) by precipitation, in the case of AgN_3, HgN_3, $Pb(N_3)_2$, TlN_3, and $Cu(N_3)_2$; (2) by dissolving the metal in the dilute acid of 16—17 per cent. strength (applicable in the case of Zn, Fe, Cd, and Mn, but the solutions are decomposed on evaporation, basic azoimides or even the hydroxides of the metal being formed and azoimide given off); (3) by dissolving the freshly precipitated hydroxide or carbonate of the metal in the aqueous acid and evaporating the solution; (4) by double decomposition of the sulphate of the metal with barium azoimide and evaporation of the filtered solution. In the analysis of the salts, the nitrogen was sometimes determined by combustion, the substance being mixed with plenty of powdered lead chromate in a long porcelain boat, but more often by distillation with dilute sulphuric acid, the azoimide evolved being collected in excess of N/10 potassium hydroxide, of which the excess was estimated with N/10 hydrochloric acid, phenolphthalein serving as the indicator; in the residue from the distillation, the metal was determined. Crystallographically the azoimides of potassium, rubidium, and thallium appear to form an isomorphous tetragonal group, those of barium, calcium (and strontium?) an isomorphous rhombic one; in all cases, the double refraction is very marked. As regards solubility in water at 16°, the azoimides of Na, K, Rb, Cs, NH_4 arrange themselves, as compared with the corresponding halogen salts, in the order of increasing solubility F, Cl, N_3, Br, I (which is also that of increasing formula-weight), those of Ba, Ca, Sr, Li, Tl in the order F, N_3, Cl, Br, I. When the azoimides of the alkali and alkaline earth metals are heated in a small capillary tube closed at one end (melting point tube), azoimide is evolved, and the metal is left (in this way, small quantities of Cs, Rb, Ba, Sr, Ca may be prepared); none of them are very explosive, only lithium and the alkaline earth azoimides exploding at comparatively low temperatures, and only thallium azoimide when hammered; in aqueous solution, they attack glass, although the acid itself has no such action; in aqueous solution, they are stable, but the solution has often an alkaline reaction. The azoimides of the heavy metals are often very explosive, perhaps most of all the potassium-platinum derivative, which explodes spontaneously with frightful violence, even in aqueous solution. No azoimide has been found as yet to crystallise with water.

Ammonium azoimide, $NH_4{\cdot}N_3$, melts and decomposes violently at 160°; very volatile; the vapour density at 100° in Hofmann apparatus gave the molecular weight $= 29{\cdot}3$; $30{\cdot}2$ (calculated 60), so that complete dissociation must have taken place; the spectrum resembles that of ammonium chloride, showing the hydrogen lines and the red-yellow part of the nitrogen spectrum; crystals apparently rhombic. Hydrazine azoimide, $N_2H_5{\cdot}N_3$, begins to melt at 65°, and decomposes energetically at 108°. *Lithium azoimide*, LiN_3 : crystals anisotropic; deliquescent; explodes between 115° and 298°. Sodium azoimide, NaN_3 : crystals apparently hexagonal; unchanged at 350°. *Potassium azoimide*, KN_3 : crystals tetragonal $(a : c = 1 : 0{\cdot}5810)$; melts and decomposes above 350°. *Rubidium azoimide*, RbN_3 : the best crystallised of the salts examined; crystals tetragonal $[a : c = 1 : 0{\cdot}5785]$; slightly hygroscopic; melts at 330—340°. *Cæsium azoimide*, CsN_3, crystalline, deliquescent; melts at 310—318°. Thallium azoimide, TlN_3 : crystals, tetragonal $[a : c = 1 : 0{\cdot}588]$; explodes when struck, also when heated strongly, but is unchanged at 340°.

Calcium azoimide, $Ca(N_3)_2$: crystals rhombic $[a : b : c = 0{\cdot}3207 : 1 : 0{\cdot}8815\ (?)]$; hygroscopic; explodes at 144—156°. *Strontium azoimide*, $Sr(N_3)_2$: crystalline; hygroscopic; decomposes violently at 194—196°. *Barium azoimide*, $Ba(N_3)_2$: crystals rhombic $[a : b : c = 0{\cdot}3424 : 1 : 0{\cdot}8461]$; hardly hygroscopic; decomposes violently at 217—221°.

Magnesium and *beryllium azoimides* are readily decomposed by hot water. Basic *zinc azoimide*, $N_3{\cdot}Zn{\cdot}OH$ (?); crystals ill-defined, anisotropic. Basic *manganese azoimide*, $N_3{\cdot}Mn{\cdot}OH$.

Cadmium azoimide, $Cd(N_3)_2$: yellow, biaxial crystals; forms with pyridine a colourless, crystalline *compound*, $Cd(N_3)_2,2C_5NH_5$. *Cupric azoimide*, $Cu(N_3)_2$, from copper sulphate and sodium azoimide, but also by dissolving copper in the aqueous acid; dark brown and crystalline; insoluble in water; very explosive.

Aluminium forms no azoimide; from a solution of the sulphate, sodium azoimide precipitates the hydroxide. Chromium azoimide is formed in solution by dissolving chromium hydroxide in aqueous azoimide; it decomposes on evaporating the solution, the residue containing only $2N_3$ per 3Cr. Ferrous sulphate gives a colourless solution with cold aqueous azoimide; on boiling, a yellow solid is precipitated. The solution turns red when shaken in the air; a deep red solution is also obtained when solutions of ferric chloride and azoimide are mixed; this becomes colourless slowly in the cold, rapidly when boiled, all the iron being precipitated.

Tin is precipitated from a solution of stannous chloride by sodium azoimide, and the precipitate is, in part at any rate, an azoimide.

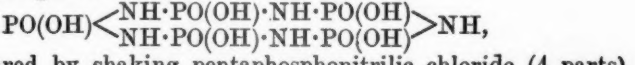
Basic *nickel azoimide*, $N_3{\cdot}Ni{\cdot}OH$, with some $Ni(N_3)_2$ (?), from nickel carbonate and aqueous azoimide: green, crystalline; explodes at 247—271°. Basic *cobalt azoimide*, $N_3{\cdot}Co{\cdot}OH$, with some $Co(N_3)_2$: violet and possibly amorphous; *potassium cobaltoazoimide*, $KN_3,Co(N_3)_2$, precipitated when strong solutions of the two azoimides are mixed, is bright blue (gives a pink solution) and crystalline, and explodes at 225°; the *ammonium* analogue, $(NH_4)N_3,(CoN_3)_2$, is similar in appearance and properties. An analogous bright green nickel compound, $KN_3,Ni(N_3)_2$ (?), also crystalline and explosive, was obtained.

By mixing strong solutions of platinochloric acid and potassium azoimide, or aurochloric acid and sodium azoimide, solutions were obtained from which, in the first case, a brownish-red, in the second an orange crystalline, residue, extremely explosive in both cases, remained on evaporation (potassium platinoazoimide and sodium auroazoimide ?).

C. F. B.

Metaphosphimic Acids. III. By HENRY N. STOKES (*Amer. Chem. J.*, 1898, **20**, 740—760 and *Zeit. Anorg. Chem.*, **19**, 36—58. Compare Abstr., 1897, ii, 28 and 94).—Although penta- and hexa-phosphonitrilic chlorides (Abstr., 1898, ii, 70), on hydrolysis give rise to the corresponding penta- and hexa-metaphosphimic acids, from heptaphosphonitrilic chloride the acid $(H_2PNO_2)_7 + H_2O$ is obtained. The salts of all three new acids differ from those of tri- and tetra-metaphosphimic acid in being amorphous; hence, in many cases, they cannot be obtained satisfactorily pure.

Pentametaphosphimic acid,



$$PO(OH){<}\begin{matrix}NH{\cdot}PO(OH){\cdot}NH{\cdot}PO(OH)\\NH{\cdot}PO(OH){\cdot}NH{\cdot}PO(OH)\end{matrix}{>}NH,$$

is best prepared by shaking pentaphosphonitrilic chloride (4 parts), dissolved in ether free from alcohol (20 parts), with a solution of sodium hydroxide (5 parts) in water (20 parts) during 50 hours. On adding alcohol, the *pentasodium* salt, $P_5N_5O_{10}H_5Na_5 + 2H_2O$, is precipitated as a thick syrup, which is washed repeatedly with 60 per cent. alcohol, dissolved in water, reprecipitated by alcohol and again washed until free from sodium chloride; it is then freed from water by stirring several hours with frequently renewed absolute alcohol. Thus prepared, it is a white, sandy powder, which retains $2H_2O$ after drying at 100°, and dissolves in water with development of heat, the solution having an alkaline reaction. When dissolved in 80 per cent. acetic acid, it is converted into the *tetrasodium* salt, $P_5N_5O_{10}H_6Na_4 + 2H_2O$; the latter is precipitated on adding alcohol and resembles the pentasodium salt, but has a neutral reaction. On adding a magnesium salt to an aqueous solution of sodium pentametaphosphimate strongly acidified with acetic acid, the *magnesium* salt, $P_5N_5O_{10}H_6Mg_2 + 5H_2O$, is precipitated; on dissolving this in dilute nitric acid, adding ammonia until a precipitate just forms, and filtering, a solution containing the *salt* $(P_5N_5O_{10}H_9)_2Mg$ is obtained. The silver salt, $P_5N_5O_{10}H_5Ag_5$, precipitated by adding the calculated quantities of nitric acid and silver nitrate to a solution of the tetrasodium salt, is a white powder, which is not affected by light or by heating at 100°; it is decomposed, however, by cold caustic alkalis. Salts containing more than five atoms of silver can be obtained, which are yellow in colour. When silver nitrate is added to an ammoniacal solution of sodium pentametaphosphimate, a yellow, amorphous *salt*, $P_5N_5O_{11}H_3Ag_9$, is obtained, which is probably a derivative of *amidotetrimidopentaphosphoric acid*, $OH{\cdot}PO(NH_2){\cdot}[NH{\cdot}PO(OH)]_3{\cdot}NH{\cdot}PO(OH)_2$. Somewhat impure pentametaphosphimic acid separates as a gelatinous precipitate on adding alcohol to the filtrate obtained after decomposing its silver salt with hydrogen sulphide.

When sodium pentametaphosphimate is heated during 8 hours with dilute acetic acid, it is decomposed into a mixture of the sodium salts of tetrametaphosphimic acid (Abstr., 1897, ii, 94), tri-imidotetraphosphoric di-imidotriphosphoric and orthophosphoric acids, together with other substances. The first of these acids is completely precipitated during the reaction as a sparingly soluble *acid sodium* salt, in spindle-shaped crystals. On concentrating the filtrate, and adding sodium acetate, *sodium tri-imidotetraphosphate*, probably $P_4N_3O_{10}H_5Na_4$, crystallises out in small rhombic or hexagonal plates; on dissolving in water and adding silver nitrate, the *silver* salt, $P_4N_3O_{10}H_5Ag_4$, separates as an amorphous precipitate which becomes crystalline on washing with water.

Sodium hexametaphosphimate, $P_6N_6O_{12}H_6Na_6 + 2H_2O$, prepared from hexaphosphonitrilic chloride, closely resembles sodium pentametaphosphimate. No definite magnesium salt could be obtained, but the *silver* salt, $P_6N_6O_{12}H_6Ag_6$, separates on adding the calculated quantity of nitric acid and silver nitrate to a solution of the sodium salt; it forms a white, gelatinous precipitate, and is decomposed by cold caustic potash. In presence of ammonia, a yellow *silver* salt is precipitated. Free hexametaphosphimic acid cannot be obtained, as on decomposing its silver salt suspended in water by hydrogen sulphide, filtering, and adding alcohol, no precipitate separates; on attempting to evaporate, decomposition occurs, and a gum-like residue is obtained.

On heating sodium hexametaphosphimate with dilute acetic acid, 30 per cent. of the theoretical quantity of tetrametaphosphimic acid is obtained.

When the hydrolysis of heptaphosphonitrilic chloride is effected by sodium hydroxide as in the case of pentaphosphonitrilic chloride, *amidohexamidoheptaphosphoric acid*,

$$OH{\cdot}PO(NH_2){\cdot}[NH{\cdot}PO(OH)]_5{\cdot}NH{\cdot}PO(OH)_2,$$

is formed; the *sodium* salt, $P_7N_7O_{15}H_{8{\cdot}57}Na_{7{\cdot}43} + 2H_5O$, and the *silver* salt, $P_7N_7O_{15}H_9Ag_7$, were analysed.

Attempts to prepare amides by acting on ethereal solutions of tetra- and penta-phosphonitrilic chloride with aqueous ammonia gave amorphous substances of indefinite composition.

In discussing his results, the author points out that tetrametaphosphimic acid is by far the most stable of the metaphosphimic acids. To explain this, and the formation of tetraphosphimic acid from the penta- and hexa-acids by hydrolysis, a hypothesis as to the stability of the acid rings is put forward, which is similar to von Baeyer's tension theory of carbon rings. W. A. D.

Atmospheric Carbonic Anhydride. By ALBERT LÉVY and H. HENRIET (*Compt. rend.*, 1898, **127**, 353—355).—When air that has been completely freed from carbonic anhydride by passing it over potassium hydroxide is allowed to remain for 2 hours in contact with potassium hydroxide solution, a further quantity of carbonic anhydride is formed (compare Abstr., 1898, ii, 573). If the potassium hydroxide solution contains 7 grams per litre, all the carbonic anhydride existing as such in the air is completely absorbed in 10 minutes, and all the organic matter in the air in the form of gas or vapour is completely oxidised in 2 hours.

Experiments were made during July, 1898, in which the carbonic anhydride absorbed by the potassium hydroxide was determined after it had been in contact with the air in large flasks for 10 minutes and 2 hours respectively. The difference was often from 3 to 5 litres per 100 cubic metres of air, but sometimes was as high as 11 or 12 litres, and in one exceptional instance it reached 56 litres. It is obvious that this difference gives useful information as to the quantity of gaseous organic matter present in the air. In all cases, the difference observed in the manner indicated is somewhat less than its true value, because even in 10 minutes the organic matter is appreciably oxidised in presence of the alkali. C. H. B.

The Various Theories relating to the Constitution of the Ammonio-metallic Salts. By Fritz Reitzenstein (*Zeit. anorg. Chem.*, 1898, **18**, 152—210).—An historical review of the theories that have been put forward on this subject. E. C. R.

Solutions of Silicates of the Alkalis. By Louis Kahlenberg and Azariah T. Lincoln (*J. Physical Chem.*, 1898, **2**, 77—90).—The conclusion arrived at by Kohlrausch (Abstr., 1893, ii, 166) that in solutions of sodium silicates these salts are hydrolytically decomposed into sodium hydroxide and colloidial silicic acid, has been confirmed by investigating the freezing points of such solutions. The freezing points and the electrical conductivity of solutions of the silicates of potassium, lithium, rubidium, and cæsium show that these salts are also decomposed by water into colloidal silicic acid and the hydroxide of the alkali metal. The silicates of the alkalis all show an analogous behaviour when dissolved in water. The same solution is obtained whether a silicate is dissolved in water, or whether solutions of caustic alkali and colloidal silicic acid in proper proportions are mixed. Since colloidal silicic acid has but little effect on the freezing point, the degree of hydrolytic decomposition of the silicates can be calculated from the lowering of the freezing point of their solutions. Silicates of the general formulæ M_2SiO_3 and $MHSiO_3$ are practically completely hydrolytically dissociated when one gram-molecule is contained in 48 litres. Silicates of the general formula $M_2Si_5O_{11}$ are practically completely decomposed by water when one gram-molecule is present in 128 litres. A comparison of the electrical conductivity of silicate solutions with that of solutions of the alkali hydroxides shows that the values of the former approach the latter as the solutions become more dilute, the retarding influence that the silicic acid has on the mobility of the ions gradually becoming less.

From the results of the above investigations, it appears safe to conclude that, in natural waters, silicic acid always occurs in the colloidal state; only in very rare instances are the solutions of the silicates so concentrated that they are not practically completely hydrolytically decomposed. H. C.

Sodium Oxides. By Robert de Forcrand (*Compt. rend.*, 1898, **127**, 364—366).—When dry air, free from carbonic anhydride, is passed through sodium heated somewhat above its melting point, the first product is a bulky, grey, arborescent mass, consisting of the suboxide Na_3O, mixed with a small proportion of sodium. If the heating is continued, this substance burns, and is converted into a yellow mixture of the monoxide and dioxide, or completely into the dioxide Na_2O_2, which, however, generally retains a small proportion of water. No trioxide is formed.

The suboxide does not rapidly absorb water vapour, but is gradually oxidised when exposed to air; if thrown into water, it reacts violently, with liberation of pure hydrogen. C. H. B.

Interaction of Sodium Arsenite and Sodium Thiosulphate. By LeRoy W. McCay (*Chem. News*, 1898, **78**, 209).—When sodium thiosulphate and sodium arsenite in the theoretical quantities are made into a thick paste with caustic soda and rubbed in a mortar, the following change takes place: $Na_3AsO_3 + Na_2S_2O_3 = Na_3AsO_3S + Na_2SO_3$. The sodium orthomonothioxyarsenate is separated by treating the paste with water, filtering, and crystallising. It is generally obtained by similar treatment of a paste of sulphur, caustic soda, and arsenious oxide in stöchiometrical amounts. D. A. L.

Saline Efflorescence of Walls. By H. van Erp (*Rec. Trav. Chim.*, 1898, **17**, 296—299).—As a rule, the efflorescence formed on walls consists almost entirely of sodium sulphate and carbonate, with varying quantities of water of crystallisation; nitrates, nitrites, phosphates, and ammonium salts can seldom be detected, but calcium carbonate and sand are usually present. In the case of a wall of a corridor in the Harlem Museum, which had been covered for some time with a curtain, it was found that, beneath the latter, a deposit of slender needles, several centimetres in length, of pure sodium sulphate (with $10H_2O$) had formed. W. A. D.

Ammoniacal Lithium Chlorides. By J. Bonnefoi (*Compt. rend.*, 1898, **127**, 367—369).—The compound $LiCl,NH_3$ is formed by the action of dry ammonia on pure and dry lithium chloride at a temperature exceeding 85°, or by heating the compounds containing a higher proportion of ammonia. Its heat of dissolution at 15° is +5·385 Cal. and hence, $LiCl$ sol. + NH_3 gas = $LiCl,NH_3$ sol. develops +11·842 Cal. Its vapour pressures are as follows.

t	88°	96°	109·2°	119°
p	256 mm.	367 mm.	646 mm.	975 mm.

and the heat of formation calculated by Clapeyron's formula agrees closely with the number directly determined.

The compound $LiCl,2NH_3$ is obtained by the action of ammonia on lithium chloride between 60° and 85°, or by heating the higher compounds between these limits. Its heat of dissolution is +2·668 Cal. hence, $LiCl$ sol. + $2NH_3$ gas = $LiCl,2NH_3$ sol. develops + 23·358 Cal Its vapour pressures are

t	68·8°	77°	83°	89·2°
p	373 mm.	558 mm.	739 mm.	980 mm.

The compound $LiCl,3NH_3$ is formed between 20° and 60°. Its vapour pressures are

t	43°	50°	60°	62·2°	65°
p	320 mm.	473 mm.	790 mm.	882 mm.	1011 mm.

The compound $LiCl,4NH_3$ is formed below 13°; its heat of dissolution is +0·292 Cal., hence $LiCl$ sol. + $4NH_3$ gas = $LiCl,4NH_3$ sol. develops +43·335 Cal., $LiCl,3NH_3$ sol. + NH_3 gas = $LiCl4NH_3$ sol. develops +8·879 Cal. Its vapour pressures are

t	0°	9°	14·5°
p	384 mm.	640 mm.	850 mm.

The heat developed by the combination of the four successive molecules of ammonia with the lithium chloride is +11·843, +11·517, +11·097, and +8·879 Cals. respectively.

In all cases, Clapeyron's formula gives results that agree with the direct determinations (compare Abstr., 1897, ii, 371). C. H. B.

Dicalcium Phosphate. By A. Barillé (*Chem. Centr.*, 1898, i, 434—435; from *Rép. Pharm.*, 1897, 529).—When ammonia is added to a solution of monocalcium phosphate, half the phosphoric acid remains in solution as ammonium phosphate, and dicalcium phosphate is precipitated. By adding calcium chloride solution to the filtrate, the rest of the phosphoric acid is precipitated as monocalcium phosphate. According to the author, the latter reaction takes place in three phases. Ammonium chloride, tricalcium phosphate, and tetrahydrogen calcium phosphate are first formed, then by the action of water the last compound forms tricalcium phosphate and phosphoric acid, and finally the whole of the tricalcium phosphate acts on the phosphoric acid to form monocalcium phosphate.

To prepare dicalcium phosphate, 1000 grams of well burnt bone ash are stirred with hot water and then gradually mixed with 1454 grams of commercial hydrochloric acid of sp. gr. = 1·17. When the action is completed, 3 litres of hot water are added, the solution of monocalcium phosphate and calcium chloride is filtered, the filtrate diluted to 10 litres and a mixture of 442 grams of ammonia of sp. gr. = 0·925 with 20 times its weight of water is slowly added. The precipitated dicalcium phosphate, after collecting, washing with water until free from acid and drying at 60°, is a light, snow-white, lustrous powder, which consists of flat, hexagonal crystals. Dicalcium phosphate crystallises with $4H_2O$. Its solution is not decomposed by boiling or evaporating, and its saturated solution in water containing carbonic anhydride contains 0·069 per cent. of the salt, and might be used medicinally instead of tricalcium phosphate. E. W. W.

Crystallisation of Anhydrous Calcium and Strontium Sulphides. By A. Mourlot (*Compt. rend.*, 1898, **127**, 408—410).—Calcium or strontium sulphide can be obtained in a crystalline condition by heating a moderately large quantity of a mixture of the corresponding sulphate with carbon for a few minutes only in an electric furnace with a current of 1000 ampères and 60 volts. If the amorphous sulphides are heated in a carbon dish in an electric tube furnace until they are completely melted, they crystallise on cooling. Both sulphides crystallise in the cubic system; the sp. gr. of the calcium compound = 2·8 at 15°, and of the strontium compound = 3·7 at 15°. In chemical properties, they closely resemble anhydrous barium sulphide (Abstr., 1898, ii, 376). C. H. B.

Composition of Phosphorescent Strontium Sulphides. By José R. Mourelo (*Compt. rend.*, 1898, **127**, 229—231).—Strontium sulphide, prepared from minerals, contains strontium sulphate, in quantity depending on the degree of exposure to air, and also small quantities of sodium chloride; it may also contain calcium, barium, iron, and aluminium compounds. When prepared from pure strontium sulphate, carbonate or oxide, it usually contains some sulphate, but if special precautions are taken and it is obtained quite pure, it is non-phosphorescent. C. H. B.

Phosphorescent Strontium Sulphide. By JOSÉ R. MOURELO (*Compt. rend.*, 1898, **127**, 372—374).—Strontium thiosulphate, prepared by the action of sodium thiosulphate on strontium chloride, retains with great tenacity small quantities of sodium chloride, and consequently this salt is present in any strontium sulphide prepared from it by the action of heat; the phosphorescence is yellowish-green, and somewhat intense.

An intensely phosphorescent sulphide is obtained by a method very similar to that adopted by Verneuil for the preparation of calcium sulphide. For 100 grams of strontium carbonate, 2 grams of bismuth subnitrate, 2 grams of sodium carbonate, and 0·12 gram of sodium chloride is taken; after moistening the carbonate with the sodium salts, it is heated to redness, and then mixed with 21 grams of sulphur and the bismuth salt, and heated to bright redness for 4 hours. The product is relatively very stable. C. H. B.

Double Compounds of Cerium Tetrachloride. By IVAN KOPPEL (*Zeit. anorg. Chem.*, 1898, **18**, 305—311).—A solution of cerium tetrachloride is obtained by treating hydrated cerium dioxide, suspended in methylic or ethylic alcohol, with dry hydrogen chloride; it forms a yellowish-brown solution, which deposits yellow, crystalline crusts when evaporated in a vacuum, and decomposes at once, with evolution of chlorine, when removed from the mother liquor or when brought into contact with water. This solution forms stable, double compounds with pyridine, quinoline, and the triethylamine chlorides, but not with mono- or di-ethylamine hydrochloride. In the preparation of these compounds, the author employed commercial cerous oxalate, and he points out that by precipitating the cerium in the form of one of these double salts, a very easy method is obtained for the preparation of pure cerium compounds.

Dipyridine cerium hexachloride, $(C_5NH_5)_2,H_2CeCl_6$, obtained by adding pyridine hydrochloride to the above solution of cerium tetrachloride and then precipitating with ether, crystallises in small, lustrous, quadratic leaflets, is easily soluble in methylic alcohol, less so in ethylic alcohol, and is at once decomposed by water, with evolution of chlorine.

Diquinoline cerium hexachloride, $(C_9NH_7)_2,H_2CeCl_6$, obtained in a similar manner to the preceding salt, is a yellow, crystalline precipitate, less soluble than the preceding salt, and at once decomposes when treated with water.

Di-triethylamine cerium hexachloride, $(NEt_3)_2,H_2CeCl_6$, crystallises well from alcohol in octahedra.

Yellow, crystalline salts, which are probably the double compounds K_2CeCl_6 and $(NH_4)_2CeCl_6$, are obtained by adding finely powdered potassium or ammonium carbonate to the solution of cerium tetrachloride containing strong hydrochloric acid, and then shaking with a large quantity of ether; when separated from the solution, they at once decompose, with evolution of chlorine. The author was unable to obtain double salts with calcium, mercury, or ferric chloride.

E. C. R.

Praseodymium. By Carl von Scheele (*Zeit. anorg. Chem.*, 1898, 18, 352—364. Compare Abstr., 1898, ii, 519).—*Praseodymium chloride*, $PrCl_3 + 7H_2O$, crystallises in large, deliquescent crystals when the concentrated solution is allowed to remain over sulphuric acid; sp. gr. at 16° = 2·251. The *bromide*, with $6H_2O$, is obtained by dissolving the oxide in hydrobromic acid. The *platinochloride*, $PrCl_3,PtCl_4 + 12H_2O$, crystallises in large, yellow crystals and slowly gives off water when allowed to remain over sulphuric acid. The *platinobromide*, with $10H_2O$, separates in large, dark red crystals and effloresces when allowed to remain over sulphuric acid. The *aurichloride*, with $10H_2O$, crystallises in beautiful, deliquescent crystals and is very soluble in water. The *auribromide* crystallises in long needles which deliquesce extremely rapidly on exposure to the air.

Praseodymium platinocyanide, $2Pr(CN)_3,3Pt(CN)_2 + 18H_2O$, obtained by adding the theoretical quantity of praseodymium sulphate to a solution of barium cyanide and platinum cyanide, crystallises in black, fluorescent prisms; it effloresces over sulphuric acid, becoming red, and giving off $4H_2O$; sp. gr. at 16° = 2·663.

Praseodymium nitrate, $Pr(NO_3)_3 + 6H_2O$, crystallises in long, deliquescent needles. The double *sodium* salt, $Pr(NO_3)_3,2NaNO_3 + H_2O$, crystallises in small, deliquescent needles. The *ammonium* salt, with $4H_2O$, crystallises in large, deliquescent crystals; sp. gr. = 2·155.

Praseodymium sulphate, $Pr_23SO_4 + 15\frac{1}{2}H_2O$, is obtained by allowing a dilute solution to crystallise very slowly; it crystallises with $8H_2O$ at the ordinary temperature; sp. gr. = 2·822; and with $5H_2O$ when a saturated solution is concentrated on the water-bath. The anhydrous salt has the sp. gr. = 3·720; 23·64 parts are soluble in 100 parts H_2O at 0°, and 17·7 parts are soluble in 100 parts H_2O at 20°. The double *potassium* salt, $Pr_2(SO_4)_3,3K_2SO_4 + H_2O$, is a heavy, crystalline precipitate, very sparingly soluble in water and easily soluble in hydrochloric and nitric acids; sp. gr. = 3·275. The double *ammonium* salt, with $8H_2O$, separates in large crystals, is not altered by exposure to the air or by remaining over sulphuric acid, is sparingly soluble in water, and becomes anhydrous when heated at 170°; sp. gr. = 2·532.

Praseodymium selenate, $Pr_2(SeO_4)_3 + 8H_2O$, is obtained by allowing a solution of the oxide in selenic acid to crystallise over sulphuric acid; sp. gr. = 3·094. It crystallises, with $5H_2O$, in prisms when the solution is concentrated on the water-bath; the *anhydrous* salt is obtained by heating the preceding salt at 200°; sp. gr. = 4·305. The double *potassium* salt, $Pr_2(SeO_4)_3,3K_2SeO_4 + 4H_2O$, is similar to the corresponding sulphate. A double salt with ammonium selenate could not be obtained.

Praseodymium dithionate, $Pr_2(S_2O_6)_3 + 12H_2O$, obtained from praseodymium sulphate and barium dithionate, crystallises from the syrupy solution when it is exposed over sulphuric acid, rapidly deliquesces on exposure to the air, and evolves sulphurous anhydride when warmed.

The *acid selenite*, $Pr_2(SeO_3)_3,H_2SeO_3 + 3H_2O$, obtained by precipitating the sulphate with sodium selenite and then adding a solution of selenic acid, crystallises in slender needles.

The *carbonate*, $Pr_2(CO_3)_3 + 8H_2O$, obtained by treating the hydroxide, suspended in water, with carbonic anhydride, or by precipitating the chloride with ammonium carbonate or potassium hydrogen carbonate, crystallises in small, lustrous scales.

The *oxalate*, $Pr_2(C_2O_4)_3 + 10H_2O$, is a crystalline precipitate, soluble in concentrated acids, and does not form double salts with alkaline oxalates. The *acetate*, with $2H_2O$, crystallises in slender needles at the ordinary temperature, and with $1\frac{1}{2}H_2O$ in small, slender needles at the temperature of the water-bath. The *propionate*, when evaporated over sulphuric acid, crystallises, with $3H_2O$, in large prisms, and on the water-bath, with $1H_2O$, in large, thin, lustrous leaflets. E. C. R.

Behaviour of Thallium in Acid Solution towards Hydrogen Sulphide in Presence of Arsenic, Antimony, and Tin. By JOSEF LOCZKA (*Chem. Centr.*, 1898, i, 657; from *Magyar Chemiai Folyóirat*, 3).—Thallium is not precipitated by hydrogen sulphide in acid solutions, but in presence of dissolved arsenic, antimony, or tin, red precipitates are formed which contain thallium. The larger the amount of acid present, the less the amount of thallium precipitated, and, with a large excess of acid, no thallium is thrown down. The arsenic precipitate, $TlAsS_2$, occurs naturally in a crystalline form in the realgar from Alchar in Macedonia. E. W. W.

Action of Water on Metallic Copper and Lead. By ROBERT MELDRUM (*Chem. News*, 1898, 78, 209—210).—In these experiments, 7 feet of bright copper wire, $\frac{1}{16}$-inch in diameter, was exposed, in a test tube, to 100 c.c. of the water; lake water, waters with and without free ammonia, and distilled water were all found to dissolve copper to a certain extent, some hundredths per 100,000 even in 24 hours.

In the lead experiments, pieces of the same lead piping, 2 inches long and $\frac{1}{2}$-inch bore, were closed at one end and each frequently filled and agitated with a different water during various periods. One water with a total hardness of 3·5° and a permanent hardness of 3·2°, dissolved considerably more lead than another with a total hardness of 18·6° and permanent hardness of 5°; a relationship that was not altered by charging both with carbonic anhydride. But the activity of the first was destroyed by thoroughly agitating with precipitated calcium carbonate and filtering. D. A. L.

Cause of the Retention and Release of Gases Occluded by Metallic Oxides. By THEODORE W. RICHARDS (*Amer. Chem. J.*, 1898, 20, 701—732).—Scott has recently stated (Trans., 1897, 559) that copper oxide prepared by exposing the nitrate to a "full red heat" in a muffle-furnace, contains only one-tenth the volume of occluded gas previously found by the author to be present in ignited copper oxide (Abstr., 1891, 805); the statement is, however, not a contradiction of the latter's results, since these were obtained at much lower temperatures, in most cases not exceeding 700°. Experiments are now described which confirm the conclusions formerly arrived at: that copper oxide prepared by the ignition of the nitrate by Hampe's method, contains between 4—5 times its volume of occluded gas, and that the latter is partially expelled at a red heat. Nearly the whole of the gas is retained until the temperature rises above 850°, when nine-tenths of it is rapidly evolved; at higher temperatures, the oxide is partially decomposed, with loss of oxygen. The amount of gas retained by the oxide below 850° does not depend on the time of ignition, although it is dependent on it above this temperature.

When zinc oxide, prepared by heating the pure nitrate during a long period at 280°, is ignited at temperatures between 660° and 880°, the amount of gas retained diminishes as the temperature rises, other conditions being the same; continued heating at one temperature causes a slow evolution of the gas. The total amount of gas occluded by zinc oxide varies greatly according to the method used for preparing the latter, and according to its physical condition. Whilst the actual amount of nitrogen occluded by the same specimen of zinc oxide is independent of the temperature at which it is subsequently ignited, the quantity of oxygen retained decreases as the temperature is increased. Richards and Rogers' results (Abstr., 1894, ii, 45) are thus confirmed, whilst Morse and Arbuckle's statement to the contrary (Abstr., 1897, ii, 334) is shown to be incorrect. In the case of copper oxide, the more rapid evolution of occluded oxygen at high temperatures is still more marked, but it is not so evident in the case of magnesium oxide.

From his results, the author concludes that the occluded gas is due to a residue of basic nitrate imprisoned in the oxides in question; that the oxygen escapes more rapidly than the nitrogen when this residue is decomposed, is explained by assuming that the loss takes place, not by diffusion, but by chemical transference. According to this hypothesis, the particles of copper oxide in immediate contact with the imprisoned gases dissociate into copper and oxygen, and then remove a portion of the occluded oxygen by combining with it; the oxygen is subsequently transferred from molecule to molecule by changes similar to those assumed to take place by Clausius's theory of electrolysis, until it finally escapes. This view is supported by the fact that the occluded oxygen is lost much more rapidly by copper oxide than by the oxides of zinc and magnesium, which are far less easily dissociated. That metallic copper is liberated when copper oxide is ignited at a red heat is shown by a great increase in the latter's conductivity; under the same conditions, the conductivity of zinc oxide was much less changed, whilst that of magnesium oxide remained unaffected. It also appears that when copper oxide is heated in a vacuum at 790°, oxygen is evolved as long as it is rapidly removed, cuprous oxide being formed. The apparent volatility of cadmium oxide at high temperatures is probably due to its initially dissociating into oxygen and cadmium, which sublimes and is then reoxidised.

W. A. D.

Action of Hydrogen Phosphide on Cupric Sulphate. By E. Rubénovitch (*Compt. rend.*, 1898, **127**, 270—273).—When hydrogen phosphide is allowed to act on cupric sulphate solution without any special precautions, the composition of the product is complex and variable, but if the pure gas, prepared from phosphonium chloride, is allowed to act on the copper salt in complete absence of oxygen, a black product is obtained which consists solely of the phosphide $P_2Cu_5 + H_2O$. One-third of the phosphorus in the hydrogen phosphide is converted into phosphoric acid, and the acid of the cupric salt is found in the free state in the liquid $10CuSO_4 + 5Ph_3 + 6H_2O = 2(P_2Cu_5 + H_2O) + H_3PO_4 + 10H_2SO_4$. The changes in the colour of the solution indicate that part of the cupric salt is first reduced to cuprous salt.

The black phosphide begins to lose water at 80° and is completely dehydrated at 150°, the colour changing to red-brown. It oxidises much more readily when anhydrous than when hydrated; in contact with the liquid in which it was formed, it is readily oxidised by air with liberation of metallic copper and formation of more phosphoric acid. Nitric acid and bromine attack the phosphide readily; potassium permanganate oxidises it, and concentrated sulphuric acid dissolves it with liberation of hydrogen phosphide. C. H. B.

Aluminium as a Reducing Agent. By Léon Franck (*Chem. Zeit.*, 1898, **22**, 236—245).—When aluminium in a finely divided state is heated to redness in an atmosphere of hydrogen and phosphorus vapour, a vigorous reaction takes place, and a dark-grey, infusible phosphide is produced having the composition Al_3P_7. An intimate mixture of aluminium and phosphorus, heated to white heat in a current of hydrogen, yields another phosphide, Al_5P_3, which forms a yellowish-grey, infusible mass. Dark blue, shining needles are obtained in small quantity by heating aluminium and phosphorus in sealed tubes, but their exact composition has not been determined. Two other phosphides, Al_3P and Al_2P_2, which have a metallic appearance and a crystalline fracture, are obtained by the use of the electric furnace. All the above phosphides give off phosphine when treated with water or acids.

A mixture of aluminium and sodium metaphosphate, when heated to redness in a current of hydrogen, yields half the phosphorus in the free state, whilst half remains combined with the metal, forming Al_5P_3; if silica be added to the mixture, the whole of the phosphorus is liberated. Calcium phosphate behaves in a similar manner, but calcium metaphosphate containing calcium sulphate cannot be employed in this experiment, as the presence of the latter salt causes explosions when the mixture is heated.

Aluminium, like magnesium, decomposes carbonic anhydride and carbonic oxide, forming the oxide of the metal and free carbon. A mixture of the metal and lampblack, when heated to a white heat, gives rise to a certain amount of aluminium carbide, which, however, cannot be separated from the excess of carbon.

The carbonates of lithium, sodium, potassium, calcium, strontium, and barium are reduced on heating with aluminium, the products being alumina, carbon, and the free elements; the latter alloy with the excess of aluminium, and in all cases a small amount of aluminium carbide is formed.

Aluminium reduces the metallic oxides when heated with them to sufficiently high temperatures; in the case of the oxides of silver, copper, and lead, the reaction proceeds with explosive violence. The oxides of iron, manganese, cobalt, nickel, chromium, and molybdenum are all partially reduced; boron and silicon are easily obtained from their oxides.

A mixture of powdered aluminium and sodium peroxide, when moistened with water, ignites spontaneously. G. T. M.

Formation of Alums by Electrolysis. By J. Lewis Howe and E. A. O'Neal (*J. Amer. Chem. Soc.*, 1898, **20**, 759—765).—The preparation of manganese alums, the primary object of the research, was not effected; various alums were, however, prepared by passing currents of 0·02—0·19 ampères through solutions of sulphates of the metals together with excess of sulphuric acid. The anode consisted of a platinum dish or crucible, and the cathode, which was immersed in a porous cup, of a platinum wire.

Iron ammonium alum was prepared by passing the current through a solution of the sulphates of ammonium and iron acidified with sulphuric acid; the alum is formed at the anode. In a similar manner, iron potassium alum, iron rubidium and iron cæsium alums, cobalt rubidium and cobalt cæsium alums were prepared.

Chromium ammonium alum was formed when the cathode dipped into a solution of ammonium chromate acidified with sulphuric acid. With manganese sulphate and the sulphates of ammonium, rubidium, and cæsium, no satisfactory results could be obtained, although Piccini has just stated that he obtained cæsium manganese alum by electrolytic oxidation (Abstr., 1898, ii, 521). From solutions containing ruthenium, no alum was obtained, but it was observed that ruthenium tetroxide was evolved at the positive pole. G. W. F. H.

Action of Water and Saline Solutions on Metallic Iron. By Robert Meldrum (*Chem. News*, 1898, **78**, 202—203).—Numerous experiments have led the author to the conclusion that the oxidation of iron in water takes place in the absence of ammonia, carbonic anhydride, or of bacteria and other forms of life, but it is uncertain whether the action is due to the water itself or to dissolved oxygen. The experiments were made with piano wire, in glass bottles free from lead, in the light; generally, a white cloud formed immediately round the metal, which extended and in 15 minutes the whole liquid became cloudy and then yellow; a yellow precipitate forming in 3 or 4 hours. Sometimes the internal surface of the glass was coated with an iridescent film, from which glistening plates became detached, and were found in the precipitate of hydrated oxides; this occurred when the surface of the iron exposed was great in proportion to the volume of water, and when there was free contact with the air. In bottles half full of solutions of pure salts, activity was observed in the following cases, the solutions employed being of 1 per cent.

strength—ammonia, sodium carbonate, sodium hydrogen carbonate, sodium hydrogen phosphate, potassium hydrogen phosphate, sodium metaphosphate, sodium pyrophosphate, and potassium borate, whilst sodium biborate and potassium biborate gave white precipitates. The following do not show any action: calcium hydroxide (saturated solution), sodium peroxide, sodium hydroxide, potassium hydroxide, barium hydroxide, strontium hydroxide (5 per cent. solution). The experiments extended, in some cases, to 4 weeks. It seems that alkaline potassium salts are more active than the corresponding sodium salts.

D. A. L.

A Double Iron Tungsten Carbide. By P. WILLIAMS (*Compt. rend.*, 1898, **127**, 410—412).—On heating a mixture of tungstic anhydride, 150 grams; iron, 250 grams, and petroleum coke, 80 grams, in a carbon crucible in an electric furnace with an arc from a current of 900 ampères and 45 volts, an iron tungsten carbide, most probably $2Fe_3C,3W_2C$, is obtained. The product is treated two or three times with hot concentrated hydrochloric acid, and the double carbide, which is highly magnetic, is separated by means of a magnet. It is then treated with aqua regia, which dissolves about half the crystals and leaves a residue of definite composition.

The double carbide thus obtained forms very brilliant, microscopic prisms with the colour of pyrites; it scratches glass easily, but not rock crystal; sp. gr. = 13·4 at 18°. At a red heat, it is not affected by hydrogen or by hydrogen sulphide, but is attacked by chlorine, bromine, iodine, and oxygen; it is not affected by water vapour at the softening point of glass, but oxidises slowly in moist air. Gaseous hydracids have no action, but their solutions decompose the carbide in sealed tubes at about 250°; nitric and sulphuric acids dissolve it rapidly, and it is also decomposed by alkalis and by oxidising agents.

C. H. B.

Tungsten Silicide. By ÉMILE VIGOUROUX (*Compt. rend.*, 1898, **127**, 393—395).—*Tungsten silicide*, W_2Si_3, forms beautiful, steel-gray plates with a metallic lustre; sp. gr. = 10·9. It is attacked by chlorine, with incandescence between 200° and 300°; by bromine, without incandescence, below a red heat, and by iodine, without incandescence, above a red heat. In oxygen, it burns very brilliantly at about 500°, and in air it oxidises below a red heat, but does not burn; nitrogen is without action at any temperature. The ordinary acids, including hydrofluoric, have no action even on heating. Aqua regia is practically without action, but a mixture of nitric and hydrofluoric acids attacks the silicide violently, even at the ordinary temperature. Alkalis in solution have little action, but fused alkali hydroxides and carbonates decompose the silicide very readily, whilst fused potassium nitrate acts with somewhat less energy.

Tungsten silicide is prepared by heating in the electric furnace a mixture of 100 grams of silicon with 230 grams of tungsten oxide obtained by heating ammonium tungstate. The heavy, brittle, crystalline product is suspended in dilute hydrochloric acid (1 in 10), and connected with the positive pole of a battery of two or three cells, a carbon plate placed in the liquid being connected with the negative pole. The metal dissolves, and the silicide, which collects at the bottom of the vessel, is treated successively with aqua regia, ammonia, and hydrofluoric acid, and any carbon silicide that may be present is separated by means of methylenic iodide. C. H. B.

Extraction of Thorium on a large Scale. By GRÉGOIRE N. WYROUBOFF and AUGUSTE VERNEUIL (*Compt. rend.*, 1898, **127**, 412—414).—The mineral is dissolved in the usual way, and the solution, which must contain sufficient acid to prevent precipitation of the phosphates, is precipitated with half the quantity of oxalic acid necessary for complete precipitation. The oxalates are washed until free from phosphoric acid, converted into carbonates by means of a hot solution of sodium carbonate (1 : 10), and some sodium hydroxide added to insure complete precipitation of the thorium. The carbonates are washed until free from oxalic acid, dissolved in just the necessary quantity of hydrochloric acid, and mixed with successive small quantities of barium peroxide suspended in water until the liquid gives no precipitate with hydrogen peroxide. The precipitated peroxide contains all the thorium, together with 20 to 30 per cent. of impurities; it is washed and dissolved in cold concentrated hydrochloric acid, barium eliminated by means of sulphuric acid, enough water added to yield a solution containing 15 per cent. of acid, and the bases precipitated with oxalic acid. The oxalates are washed, and treated with a highly concentrated solution of ammonium carbonate mixed with sufficient ammonia to form the normal salt. By two or three successive treatments, all the thorium is dissolved, and the solution is precipitated by means of sodium hydroxide, the precipitate well washed and dissolved in not more than the requisite quantity of nitric acid, and the liquid poured into sufficient water to yield a solution containing not more than 2 per cent. of thorium. Excess of hydrogen peroxide is then added, and the precipitate is well washed.

From this point, all the reagents must be pure. The precipitate is dissolved in nitric acid and reprecipitated with hydrogen peroxide in order to eliminate all the cerium. It is next dissolved in hydrochloric acid, precipitated with oxalic acid, and the oxalate decomposed by pure sodium hydroxide. After careful washing, the precipitate is again dissolved in hydrochloric acid and precipitated with ammonia. This final precipitate is well washed, dissolved in nitric acid, and the nitrate crystallised.

In treating 5 tonnes of monazite, the authors never obtained, either in the hydrogen peroxide precipitate or in the ammonium carbonate solution of the oxalates, any element corresponding with the *Russium* of Chrustchoff. C. H. B.

Electrolytic Gold Refining. By EMIL WOHLWILL (*Zeit. Elektrochem.*, 1898, **4**, 379, 402, and 421).—Solutions in potassium cyanide cannot be used, because silver and copper are deposited along with the gold. When neutral solutions of auric chloride or of hydrogen aurichloride, $HAuCl_4$, are used, chlorine is evolved and the gold anode is not attacked. With hydrochloric acid alone, even so dilute as 0·4 gram per litre, or with solutions of hydrogen aurichloride acidified with hydrochloric acid, no chlorine is evolved, and the gold is dissolved;

the chlorides of the alkalis or of ammonium have the same effect as hydrochloric acid. In order that the gold anode shall dissolve, it is, therefore, necessary that the conditions permit of the formation of $AuCl_4$ ions. The behaviour of gold chloride solutions towards silver nitrate confirms Hittorf's conclusion as to the existence of these ions; reddish-yellow precipitates are invariably formed on adding the silver nitrate; they are, however, much less stable than the analogous silver platinochloride. The dissolution of the anode is also promoted by raising the temperature to 60° or 70°, and in a hot solution containing about 3 per cent. of hydrochloric acid, an anodic current density of 3000 ampères per square metre may be employed without separation of free chlorine; this is more than sufficient for practical purposes. At the cathode, a fairly high current density may be employed without injury to the gold deposit, and without necessitating the use of too concentrated a gold solution; the deposit is usually coarsely crystalline, and sufficiently adherent to permit of thorough washing without loss. The greater the concentration of the gold solution, the better the deposit; 30 grams of gold per litre is, however, sufficient, even with 3000 ampères per square metre. No trouble is experienced from the formation of dendritic deposits, so that the electrodes may be placed close together, and a considerable output be obtained from a small plant.

Of the impurities in the gold, platinum and palladium pass into solution, but are not deposited at the cathode; after they have accumulated sufficiently, the solutions are worked up to recover them. Silver remains, mainly as a mud of silver chloride; the small part which dissolves in the hot acid solution does not pass into the deposited gold. The refined gold is very seldom less than 999·8 fine, not infrequently it is 1000. The E.M.F. required with a current density of 1000 ampères per square metre is less than 1 volt.

On the assumption that only tervalent gold exists in the solution, 2·45 grams should be deposited per ampère hour. The author's experiments, as well as the results obtained in large scale working, show that more nearly 3 grams per ampère hour are obtained. A consideration of the loss of gold at the anode gives the explanation of this. Part of the loss is due to the separation of fine particles of gold which are found, for the most part, in the silver chloride mud. These particles are equal to about one-tenth of the amount of gold deposited on the cathode, and are not merely mechanically detached from the anode, but are due to the formation of aurous chloride at its surface, which subsequently decomposes into metallic gold and auric chloride. In support of this view, the author shows that the particles are much purer than the anode itself; that aurous chloride may be detected in the solution, and that, under certain circumstances, small crystals of gold separate out throughout the mass of the solution. The presence of aurous gold with three times the electro-chemical equivalent of the auric gold readily accounts for the large deposit observed. The part of the gold dissolved from the anode in the aurous state, which decomposes into metallic gold and auric chloride, never reaches the cathode, and, therefore, the loss at the anode is always greater than the deposit at the cathode. A series of experiments with varying anodic current densities shows that the formation of univalent gold ions diminishes as the current density increases. With 1500 ampères per square metre, 2·48 grams of gold per ampère hour were deposited (instead of 2·45), and the loss at the anode and gain at the cathode, in two experiments, were (1) 105·2 : 104·5 ; (2) 107·7 : 105. Here, therefore, tervalent gold was present almost exclusively. Such results are only obtained when the liquid is well stirred ; otherwise, owing to the accumulation and decomposition of aurous chloride at the anode, the loss there is much in excess of the cathode gain. In experiments with very small current densities, the non-electrolytic solution of gold in the hot, acid auric chloride solution must be allowed for. This appears to be reversible, a sheet of gold losing weight when the temperature is raised, and gaining it when it is lowered again. After allowing for this chemical attack, the author obtained with 1 ampère per square metre a deposit of 4·33 grams per ampère hour, and an anodic loss of 6·01 grams, that is, 72·5 per cent. of the gold had dissolved in the aurous state.

T. E.

Claims of Davyum to Recognition as an Element. By JOHN W. MALLET (*Amer. Chem. J.*, 1898, **20**, 776—783).—Kern (this Journal, 1877, ii, 278 and 712) has stated that platinum ores contain a small quantity of a new metal, "davyum," characterised by its chloride combining with that of sodium to form a sparingly soluble double salt. In the hope of separating this metal, the author has examined the sparingly soluble residue remaining after clearing a solution of platinum ore in aqua regia from osmiridium by decantation, removing the platinum by adding ammonium chloride, adding an excess of common salt, evaporating to dryness, and extracting the residue with a minimum of water. It was found, however, to consist only of quartz, zircon, iridium, rhodium, and osmium.

From a large quantity of rose-coloured crystals of sodium chloride recovered during the manufacture of platinum, a very small amount of a metallic substance was isolated, which, judging from an analysis of the double chloride, appeared to have an atomic weight of about 151·5, corresponding with the value 154 attributed by Kern to davyum. Its solution also in aqua regia gave a red coloration with potassium thiocyanate, a reaction characteristic of davyum. Since, however, it was found to consist merely of rhodium and iridium with a trace of iron, the existence of davyum is considered as very doubtful.

W. A. D.

Mineralogical Chemistry.

Origin of the Freiberg Mineral Veins. By ALFRED W. STELZNER (*Zeit. prakt. Geol.*, 1896, 377—412).—Sandberger has found the mica from the gneisses carrying the Freiberg lead veins to contain small quantities of heavy metals, and on this he founded his theory of lateral secretion to explain the origin of mineral veins. The present author gives the results of numerous analyses made on large quantities of fresh mica from the Freiberg gneiss and from the gneisses and granites of the Black Forest, but these do not confirm Sandberger's results. None of these micas show the presence of heavy metals (lead, silver, &c.) other than small quantities of cobalt, nickel, copper, and zinc, and since sulphur was also found these probably exist as sulphides mechanically enclosed in the mica, rather than as silicates entering into the constitution of the mica, as was supposed to be the case by Sandberger. Several other arguments are brought against the theory of lateral secretion. The material of the veins has more probably been brought up from great depths by mineral waters, and only a small amount leached out of the rocks surrounding the veins.

L. J. S.

Copper, Bornite, and Petalite from the Caucasus. By PAVEL V. VON JEREMÉEFF (*Zeit. Kryst. Min*,, 1898, **30**, 388 ; from *Verh. kais. russ. min. Ges.*, 1896, **34**, 55).—Distorted crystals of native copper and cubes of erubescite (= bornite) with convex faces are described. Petalite from the Amanaus glacier, Batalpaschinsk district, gave, on analysis by J. A. Antipow,

SiO_2.	Al_2O_3.	FeO.	CaO.	MnO.	Na_2O,K_2O.	Li_2O.	Loss on ignition.
77·28	14·82	1·08	0·58	trace	2·07	1·97	0·45

L. J. S.

Diaphorite from Washington and Mexico. By LEONARD J. SPENCER (*Amer. J. Sci.*, 1898, [iv], **6**, 316).—Orthorhombic crystals of the rare mineral diaphorite are noted from two new localities: (1) Lake Chelan district, Okanogan Co., Washington; associated with stephanite and pyrargyrite; (2) Santa Maria de Catorce, San Luis Potosi, Mexico; with miargyrite.

The three minerals, andorite (Abstr., 1898, ii, 120), diaphorite, and freieslebenite, are strikingly similar in appearance, and between them there is the same kind of morphotropic relation as that which exists between the members of the humite group (Abstr., 1894, ii, 241).

	a *b* *c*	Sp. gr.	Chem. comp.
Andorite............	0·9846 : 1 : 0·6584	5·35	$(Pb,Ag_2)S,Sb_2S_3$
Diaphorite	0·9839 : 1 : 0·7345	5·9	$5(Pb,Ag_2)S,2Sb_2S_3$?
Freieslebenite ...	0·9786 : 1 : 0·9277 β=87° 46′.	6·3	$5(Pb,Ag_2)S,2Sb_2S_3$

Since, in diaphorite, the vertical axis *c* and the sp. gr. fall between those of andorite and freieslebenite, it is to be expected that it should also be intermediate in composition. Brongniardite, which has such an intermediate formula, namely, $2(Pb,Ag_2)S,Sb_2S_3$, agrees in sp. gr. and external characters with diaphorite; it therefore seems very probable that brongniardite and diaphorite are identical. (The so-called cubic crystals of brongniardite are identical with stanniferous argyrodite, Abstr., 1898, ii, 436.) L. J. S.

Cubanite from Butte, Montana. By HORACE V. WINCHELL (*American Geologist*, 1898, **22**, 245).—A brass-yellow mineral, now being mined as a copper ore at Butte, gave, on analysis by S. J. Gormly,

Cu.	Fe.	S.	SiO_2.	Ag.	Au.
25·04	34·26	39·90	0·77	0·96 oz.	trace

Other determinations of the copper gave 25·35, 19·8, and 23·6 per cent. The excess of copper over that required by the cubanite formula, $CuFe_2S_4$, is probably due to the presence of bornite.

L. J. S.

Lonchidite from Olkusch. By J. A. ANTIPOW (*Zeit. Kryst. Min.*, 1898, **30**, 388; from *Verh. kais. russ. min. Ges.*, 1896, **34**, 24).—A spheroidal concretion of marcasite with fibrous structure was found to contain As, 5; Te, 0·3 per cent. L. J. S.

Nickeliferous Magnetites. By WILLET G. MILLER (*Rept. Brit. Assoc.*, 1898 [for 1897], **67**, 660—661).—Samples of ore from the larger deposits of titaniferous magnetite in eastern Ontario have been found to contain nickel (and cobalt) to the extent of 0·8 per cent. No nickel has been found in the non-titaniferous magnetites of the district. The former are considered to be of igneous origin, and the latter of aqueous or mechanical origin. The high quality of iron extracted from the titaniferous ores may be due to the presence of nickel. L. J. S.

Interaction of Calcium Hydrogen Carbonate and Alkali Sulphate: Formation of Alkali Carbonates in Nature. By HEINRICH VATER (*Zeit. Kryst. Min.*, 1898, **30**, 373—386).—Hilgard and Tanatar have determined the amount of alkali carbonate which, with gypsum, is formed when carbonic anhydride is passed through a solution of alkali sulphate in contact with an excess of calcium carbonate, and they have explained the natural formation of alkali carbonates by this reaction (Abstr., 1893, ii, 165; 1896, ii, 419; 1897, ii, 58). The present author adversely criticises these results, and considers that alkali carbonates in the solid form cannot be obtained in this manner. The alkaline reaction of the solution he attributes to calcium carbonate. From solutions not in contact with solid calcium carbonate, there is a separation of calcium carbonate or of the double salt, $K_2SO_4,CaSO_4,H_2O$, but not of gypsum or alkali carbonate. L. J. S.

Alkaline Reaction of some Natural Silicates. By FRANK W. CLARKE (*J. Amer. Chem. Soc.*, 1898, **20**, 739—742).—The author describes experiments on the decomposing action of pure water on various natural silicates. For this purpose, the finely-powdered mineral was shaken with water to which a minute quantity of phenolphthalein had been added, the alkalinity of the water, as measured by the depth of colour imparted to it in the presence of the phenolphthalein, being taken as a measure of the susceptibility to decomposition by water of the mineral in question.

Amongst the micas, muscovite and lepidolite are only very slightly affected by water, whereas phlogopite, a magnesium mica, is readily attacked; similarly, orthoclase is but slightly acted on, oligoclase more readily, albite still more readily. These observations are in accord with the observed susceptibility to weathering of the minerals in question.

Leucite, nephelite, spodumene, scapolite, laumontite, stilbite, chabazite, and thomsonite gave very little coloration; heulandite and analcite stronger colorations; cancrinite, sodalite, natrolite, pectolite, apophyllite, ægirite still stronger colorations. G. W. F. H.

[Baddeckite, Tennantite, &c., from Canada.] By G. Christian Hoffmann (*Ann. Rept.* [1896], *Geol. Survey Canada*, 1898, **9**, R, 1—53).—The name baddeckite is given to a micaceous mineral occurring as minute scales and scaly aggregations in clay at Baddeck, Victoria Co., Nova Scotia. It is copper-red and gives a tile-red streak; before the blowpipe, it fuses to a black, magnetic glass, and it is decomposed by strong hydrochloric acid, with separation of gelatinous silica. Analysis by R. A. A. Johnston gave,

SiO_2.	Al_2O_3.	Fe_2O_3.	CaO.	MgO.	K_2O.	Na_2O.	H_2O.	Total.	Sp. gr.
48·96	13·85	25·82	1·17	2·65	3·47	0·22	3·78	99·92	3·252

Formula, $2H_2O,(Ca,Mg,K_2,Na_2)O,3(Al,Fe)_2O_3,8SiO_2$. The mineral is, therefore, considered to be a variety of muscovite (hydromuscovite) with alumina largely replaced by ferric oxide. (Also in *Amer. J. Sci.*, 1898, **6**, 274).

Tennantite occurs near the Bonaparte River, Lillooet district, British Columbia; it is usually massive, but rarely in tetrahedra. Colour, dark greyish-black; thin splinters are translucent and deep ruby-red by transmitted light; streak, cherry-red. It contains 41·51 Cu and 0·2385 Ag per cent.; besides much arsenic and sulphur, there are also small quantities of Sb, Pb, Zn, and Fe. Chalcanthite, in fine specimens, results from the alteration of this tennantite.

A straw-yellow, crystalline incrustation on limestone in the Alberta district, North-west Territory, is readily soluble in water, and gave on analysis by Johnston,

SO_3.	Fe_2O_3.	FeO.	Al_2O_3.	MgO.	H_2O.	Insol.	Total.
36·43	13·15	0·93	5·57	5·92	36·98	0·48	99·46

This corresponds with a mixture of epsomite and a hydrated basic ferric sulphate, possibly fibroferrite.

Xenotime, in masses weighing up to 312 grams, occurs in a granite vein at Calvin, Ontario; sp. gr. = 4·395.

The report also includes various other mineralogical notes (with partial analyses and sp. gr. determinations), also analyses of coals, rocks, waters, nickel and cobalt ores, and the results of numerous gold and silver assays. L. J. S.

Kaolinite Deposits of South Russia. By Petr A. Zemjatschensky (*Zeits. Kryst. Min.*, 1898, **30**, 389; from *Trav. Soc, Naturalistes, St. Petersbourg*, 1896, 1—322).—Kaolinite from various Russian localities is described from geological and chemical points of view. The following formulæ are given. $2Al_2O_3,5SiO_2$ ($= Al_2O_3,3SiO_2 + Al_2O_3,2SiO_2$); $Al_2O_3,2SiO_2$; $Al_2O_3,3SiO_2$; $2Al_2O_3,7SiO_2$ ($= Al_2O_3,2SiO_2 + Al_2O_3,5SiO_2$); $Al_2O_3,5SiO_2$; $3Al_2O_3,20SiO_2$; $8Al_2O_3,15SiO_2$. Water begins to be given off at 300°; between 300—400°, a small portion is expelled, and complete dehydration is effected at 700—770°. Kaolinite has an acid character, in that the hydrogen, or a part of it, is easily replaced by a metal. With haloid compounds of the alkalis, it gives a product allied to muscovite, and with sulphur compounds it gives hydrogen sulphide. With ferrous sulphate at a high temperature and pressure, sillimanite, or a product resembling chlorite, is formed. L. J. S.

Norites [Hypersthene, Diallage, Enstatite, and Anorthoclase] from the Transvaal. By J. A. LEO HENDERSON (*Inaug.-diss. Leipzig* (*London*), 1898, pp. 1—56).—The following analyses by Röhrig are given of minerals separated by heavy liquids from some of the South African rocks described in this thesis. Diallage-norite (sp. gr. = 3·01) from the Zwaartkoppies range is composed of basic plagioclase (sp. gr. = 2·7), hypersthene, diallage, and a colourless to pale-green pyroxene resembling salite. The hypersthene (anal. I) is strongly pleochroic, and the diallage (II), with extinction angle 46°, contains numerous acicular enclosures, possibly of rutile; the hypersthene and diallage form very intimate regular intergrowths, and it was not possible to obtain absolutely pure material for analysis. The analyses give the formula $R''O,SiO_2$, with some $MgO,(Fe,Al)_2O_3,4SiO_2$. Hypersthene, in a similar rock (sp. gr. = 2·87) from the same locality, gave III. Hypersthene-norite (sp. gr. = 2·93), from the Hex River near Rustenburg, consists of plagioclase (sp. gr. = 2·71) and pleochroic hypersthene (IV); the latter encloses numerous small, colourless plates, probably of plagioclase, arranged parallel to the pinacoid faces. A finely crystalline quartz-norite (sp. gr. = 2·97), from the Marico district, is composed of felspar, hypersthene, diallage, quartz, and biotite; the hypersthene (V, also alkalis 2·17; MnO, 0·67 per cent., and Cr_2O_3, trace) is only very slightly pleochroic, and the material analysed enclosed plates of biotite arranged parallel to the pinacoid faces. The quartz in this rock forms micropegmatitic intergrowths with the felspar. These norites, which have been previously described as gabbros, contain no olivine. An enstatite-pyroxenite, from the Marico district, composed entirely of granules of green enstatite, gave anal. VI. The enstatite, however, encloses numerous minute plates of anorthite, as shown by the analysis, to the extent of 4·5 per cent.

	SiO_2.	TiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	MgO.	CaO.	H_2O.	Total.	Sp. gr.
I.	51·64	0·34	1·32	4·41	18·62	14·74	6·46	1·50	99·03	3·50
II.	52·54	0·21	0·24	5·12	12·46	12·02	17·12	—	99·71	3·36
III.	54·49	—	trace	21·84		19·21	4·40	—	99·94	3·38
IV.	50·28	0·24	1·49	9·79	7·82	23·00	7·33	0·16	100·11	3·36
V.	53·35	0·36	4·50	5·12	13·32	16·15	4·42	0·40	100·46	3·366
VI.	55·23	0·44	2·08	3·94	6·25	29·29	1·68	1·12	100·03	3·297

Amphibole-pyroxene-syenite (hatherlite), from Hatherley near Pretoria, is composed of anorthoclase, hornblende, pyroxene, and biotite, with very little quartz. The large anorthoclase crystals have an angle of optical extinction on *c*(001) of 9—12°; they consist of a core of white felspar (anal. VII) surrounded by a zone of red felspar (VIII). Large porphyritic crystals of dark-red anorthoclase in porphyry (pilandite) from the Pilandsberge gave IX; the ground-mass of this rock consists of red felspar and amphibole, with very little quartz. From these analyses, small quantities of Fe_2O_3, MgO, and H_2O have been eliminated. These rocks, to which the new names hatherlite and pilandite are given, are considered to be the plutonic and porphyritic equivalents respectively of the volcanic anorthoclase-bearing rock pantellarite.

	SiO_2.	Al_2O_3.	CaO.	Na_2O.	K_2O.	Total.	Sp. gr.
VII.	61·81	24·68	2·71	7·53	3·37	100·10	2·65
VIII.	64·06	21·68	1·87	7·53	4·50	99·64	2·56
IX.	66·31	20·60	0·48	7·54	4·92	99·85	2·60

L. J. S.

Origin, Composition, and Alteration of Glauconite. By Konstantin D. Glinka (*Zeit. Kryst. Min.*, 1898, **30**, 390—391; St. Petersburg, 1896, pp. 114. Compare Abstr., 1896, ii, 568; 1897, ii, 54).—Ten analyses are given of glauconite isolated from Russian sandstones, and one limestone; the extreme amounts of each constituent are quoted below. The dark-green grains have sp. gr. = 2·7—2·8, and the yellowish green 2·4—2·5.

SiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	CaO.	MgO.	K_2O.	Na_2O.	H_2O at 100°.	H_2O on ignition.	Sp. gr.
41·02	5·84	8·17	1·32	—	0·69	5·74	0·30	2·42	4·45	2·400
52·96	22·19	23·43	5·95	8·37	4·11	9·54	0·98	7·79	7·88	2·867

Glauconite and celadonite, when heated with potassium carbonate solution, take up potassium; solutions of various chlorides have no action. L. J. S.

Granitic Rocks of the Riesengebirge. By Ludwig Milch (*Jarhb. f. Min.*, 1898, Beil. Bd. 12, 115—237).—In this petrographical paper, the following analyses of biotite are given by W. Herz. I. Biotite from biotite-granite of the Schneekoppe; the rock itself gave anal. III. II. Biotite from a basic streak in biotite-granite from Arnsdorf; the streak gave anal. IV., and the biotite-granite gave V. Twenty-one other rock analyses are given.

	SiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	CaO.	MgO.	K_2O.	Na_2O.	H_2O.	Total.
I.	40·38	15·40	5·26	7·73	—	19·87	7·11	1·80	1·68	99·23
II	39·66	14·26	4·01	8·10	—	20·48	7·99	2·60	2·04	99·14
III.	72·81	15·22	1·88	1·40	2·77	1·10	1·54	2·10	1·66	100·48
IV.	63·06	18·01	2·48	1·91	2·72	4·55	3·88	2·01	2·20	100·22
V.	74·65	12·64	2·26	0·85	2·12	1·01	2·37	3·41	1·14	100·45

L. J. S.

Dunite in Massachusetts. By G. C. Martin (*Amer. J. Sci.*, 1898, [iv], **6**, 244—248).—A boss of dunite is intrusive into the gneisses near Chester, in the Green Mountain region of western Massachusetts. It is in part altered to serpentine. The pale green olivine isolated from the altered rock gave, on analysis,

SiO_2.	Al_2O_3.	FeO.	MgO.	CaO.	H_2O.	Total.	Sp. gr.
40·07	1·94	4·84	51·41	—	1·03	99·29	3·27

L. J. S.

Vanadium and Molybdenum in Rocks of the United States. By William F. Hillebrand (*Amer. J. Sci.*, 1898, [iv], **6**, 209—216; and *Chem. News*, 1898, **78**, 216—219).—Vanadium has long been known to occur in small quantities in various rocks and minerals. Quantitative determinations of the vanadium present in 64 rocks from the United States show that it occurs in appreciable amounts in the more basic igneous and metamorphic rocks (up to 0·08 per cent. of V_2O_3), but that it is absent, or nearly so, in the highly siliceous rocks. The existence of the vanadium mica, roscoelite, suggests that this element is present as V_2O_3 rather than as V_2O_5, and that it occurs in the heavier aluminous silicates biotite, pyroxene, and amphibole. Determinations of the amount of vanadium in these minerals are given; for example, in biotite (0·127 per cent. V_2O_3), isolated from pyroxenic gneiss (0·083, V_2O_3) from Calaveras Co., California; amphibole (0·037, V_2O_3) from Californian amphibole-gabbro (0·02, V_2O_3).

Molybdenum was found in only a few of the rocks, and then only as traces in the more acid ones.

Full details are given of the methods and precautions used in the analyses. The determinations were made on 5 grams of material.

L. J. S.

Meteoric Iron from Beaconsfield. By EMIL W. COHEN (*Sitz.-ber. Akad. Berlin*, 1898, 306—307. Compare Abstr., 1898, ii, 171).—In the previous description of this iron, it was stated that carbon having the appearance of anthracite was present; this was found after dissolving the meteoric iron in dilute hydrochloric acid, and treating the residue with cupric ammonium chloride in order to separate the tænite and cohenite from the schreibersite and rhabdite. It is now found that this anthracitic carbon is not an original constituent of the iron, but is formed by the action of the cupric ammonium chloride on the cohenite. Although cohenite, Fe_3C, contains only about 6½ per cent. of carbon, this carbonaceous residue is compact and shining. The crystals of cohenite from the Toluca and Beaconsfield irons give homogeneous solid pieces, whilst the crystalline aggregates of cohenite from the Niakornak iron give finely granular carbon possessing little cohesion.

It is suggested that some anthracites, for example that of mineral veins, may have been formed by the alteration of carbides, which are now known to be of terrestrial origin (Abstr., 1898, ii, 83, 232).

L. J. S.

Meteoric Iron from San Cristobal, Chili. By EMIL W. COHEN (*Sitz.-ber. Akad. Berlin*, 1898, 607—608).—Four fragments of this iron were brought to Europe in 1896 from the San Cristobal gold-mining district near Antofagasta in Chili; one of the fragments weighs 60 grams. Troilite nodules are surrounded by a zone of schreibersite, and this again by a zone of dark nickel-iron. The main mass of the iron shows an intricate structure on the surface; this appears to be due to minute lamellæ, which are much bent and twisted. Putting aside the Oktibbeha Co. and Santa Catharina irons as being doubtfully meteoric, this iron differs from all other meteorites in the high percentage of nickel and in its peculiar structure; it is, therefore, placed in a special class of the ataxites. Analysis by O. Sjöström gave

Fe.	Ni.	Co.	P.	Total.	Sp. gr.
73·72	25·60	1·00	0·18	100·50	7·8593

L. J. S.

Mineral Water from Selters, Nassau. By HEINRICH FRESENIUS (*Jahrb. Nassau Ver. Naturk.*, 1898, **51**, 1—23).—Water from a new boring at Selters, near Weilburg, on the Lahn, is clear and has a temperature of 13°; sp. gr. = 1·004182 at 20°. It contains in 1000 parts: Na_2CO_3, 0·200786; Li_2CO_3, 0·010135; $(NH_4)_2CO_3$, 0·003693; K_2SO_4, 0·028505; KCl, 0·015267; NaCl, 1·889081; NaBr, 0·000854; NaI, 0·000017; Na_2HPO_4, 0·000302; $CaCO_3$, 0·779638; $MgCO_3$, 0·359795; $FeCO_3$, 0·008784; $MnCO_3$, 0·003115; SiO_2, 0·020180 = 3·320152; CO_2 in bicarbonates, 0·627025; free CO_2, 2·58583. Also traces of barium, strontium, alumina, and boric acid. It is an acid water containing much sodium chloride and carbonates of calcium, &c. L. J. S.

Physiological Chemistry.

Relation of the Blood to the Automaticity and Sequence of the Heart-beat. By WILLIAM H. HOWELL (*Amer. J. Physiol.*, 1898, **2**, 47—81).—A strip of vena cava from the terrapin's heart may be kept in rhythmic action for 2 days or more, when immersed in a bath containing only sodium chloride, potassium chloride, and calcium chloride; this fact renders improbable Kronecker's theory, that the cardiac tissue beats only so long as serum-albumin is supplied to it. The energy is evidently derived from material within the cardiac tissue, and if supplied with an adequate stimulus, the beat will continue until this is consumed. The normal stimulus is dependent on calcium compounds, but for rhythm, potassium salts are also necessary. The proportion of the three salts necessary is that which occurs in the blood, and the sodium chloride must be isotonic with the blood, and is essential only to preserve the normal osmotic relations between the tissues and the surrounding liquid.

Such a liquid will not keep the ventricle of frog or terrapin in action, although it will that of the cardiac tissue at the venous end of the heart. The normal heart's rhythm is, therefore, started at the venous end, because that part of the heart is alone susceptible to the salts of the blood. W. D. H.

Relation of the Inorganic Salts of the Blood to the Automatic Activity of Ventricular Muscle. By CHARLES WILSON GREENE (*Amer. J. Physiol.*, 1898, **2**, 82—126).—Normal serum will not keep a strip of the apex of the terrapin's heart in contraction, although it remains alive for several days. Regular contractions may, however, be produced by increasing the amount of calcium chloride in the serum. The same is true for a solution of the blood salts (like Ringer's fluid) similar to those used by Howell (see preceding abstract). Sodium chloride will sustain contractions only for a short time, and these present the appearance of fatigue owing to the removal of the inorganic salt necessary for contraction. Calcium salts in isotonic solutions of sodium chloride stimulate the strip to increased rhythm and final contracture. Potassium chloride in a similar solution produces relaxation.

Cane-sugar and urea in isotonic solutions do not produce rhythmic contractions in the isolated strip; dextrose increases muscular tone and may produce an imperfect series of contractions. W. D. H.

Functions of the Thyroid Gland. By F. Blum (*Zeit. physiol. Chem.*, 1898, **26**, 160—174).—The paper is largely critical. The author believes the thyroid is an excretory organ removing poisonous substances from the blood, and that the iodine formed there originates in that way. He regards the iodine as in organic union with proteid material, and iodothyrin as an artificial product. W. D. H.

Active Physiological Substance of the Suprarenal Capsules. By Otto von Fürth (*Zeit. physiol. Chem.*, 1898, **26**, 15—47).—Various methods are described in which an attempt was made to isolate the active substance in extracts of the suprarenal capsules. Although the author still continues to speak of the material as catechol-like, he admits that Moore is right when he places the substances among the derivatives of pyridine. He suggests with reserve that it is a hydrogenised dihydroxypyridine. W. D. H.

Æolosomin. By Arthur Bower Griffiths (*Compt. rend.*, 1898, **127**, 448—449).—The cellules of *Æolosoma tenebrarum* contain a green pigment which has a respiratory function. It dissolves in acids, forming a green solution which is coloured purple by alkalis, but changed back again to green by excess of acid. It also dissolves in turpentine. The solutions of the pigment show no definite absorption bands.

Æolosmin exists in two forms, æolosomin and oxyæolosomin; the empirical composition of the former is $C_{420}H_{630}N_{103}FeS_2O_{152}$. C. H B.

Human Milk. By Vanderpoel Adriance and John S. Adriance.—This pamphlet records analyses of 200 specimens of human milk obtained by the breast pump. These are arranged according to the time after parturition. The fat is variable, and shows no constant change. The lactose on the second day of lactation is low, but then rises rapidly; this increase continues more slowly until the end of lactation; the proteids and salts pursue a reverse course. In the later months of lactation, the total solids decrease steadily. The colostrum period has low carbohydrate with a tendency to increase rapidly, and high proteids and salts with a tendency to decrease rapidly.

In cases of abnormal milk, excessive fats or proteids, especially during the colostrum period, cause gastro-intestinal symptoms in the child. The excess in the milk may be reduced by diminishing the proteid food, and increasing the exercise of the mother. Deterioration in the milk is marked by reduction in proteids and total solids, or in the proteids alone. Such deterioration is normal in the later months, and indicates that additions to the infant's diet are necessary.

W. D. H.

Supposed Existence of Iodine in Organic Combination in the Urine after the Administration of Potassium Iodide. By DIOSCORIDE VITALI (*L'Orosi,* 1898, **21**, 145—153).—The urine excreted by subjects to whom pure potassium iodide had been administered was treated with baryta water to remove phosphates and urates, the chlorides and iodides precipitated by silver nitrate, the excess of the latter removed by means of sodium chloride, and the filtered liquid mixed with caustic potash and potassium nitrate and evaporated to dryness. No iodine could be detected in the fused residue until after reduction with sulphurous acid, the whole of the "organic iodine" having been converted into iodate by the large excess of nitrate. Chlorides, under the same conditions, are partially converted into chlorates, and this fact may account for the discrepancies between the statements made by different observers as to the existence of "organic chlorine" in urine. Experiments were made to ascertain whether the "organic iodine" was present as iodoleic acid, by extracting the concentrated and acidified urine with ether. By this process, organic compounds containing iodine were certainly obtained, but they were formed during the extraction, since similar results were obtained with normal urine to which potassium iodide had been added. The author concludes that, although organic iodine compounds may, perhaps, be formed in certain organs and tissues of the body, yet the iodine contained therein passes into the urine in the form of alkali iodides which may subsequently, after excretion, undergo decomposition with the formation of organic compounds of iodine.

N. L.

Organic Phosphorus in Urine. By HORST OERTEL (*Zeit. physiol. Chem.*, 1898, **26**, 123—130).—Several previous observers have realised that all the phosphorus in the urine is not combined as phosphoric acid, but that there are organic compounds like glycerophosphates present.

The total phosphorus may be estimated as phosphate after fusing the dry residue of the urine with potassium hydroxide and nitrate. The organic phosphorus may be similarly estimated after precipitating the inorganic phosphates with calcium chloride and ammonia.

If the total phosphates in the day's urine amount to 2 grams, 0·05 gram comes from the organic phosphorus compounds; this varies, however, with nitrogenous metabolism; muscular exercise has no effect on it.

W. D. H.

Uric Acid and the Acidity of Urine. By W. J. SMITH JEROME (*J. Physiol.*, 1898, **23**, 315—324).—The urine in healthy persons may be made to deposit uric acid by the ingestion of a sufficient quantity of food rich in nuclein. Some urines after an ordinary diet have an abnormal tendency to the precipitation of uric acid; this tendency is not always due either to a high degree of acidity, or to a high percentage of uric acid in the urine, or to the coexistence of these two conditions, however much such conditions may favour the precipitation.

W. D. H.

Uric Acid and Diet. By F. GOWLAND HOPKINS and W. B. HOPE (*J. Physiol.*, 1898, **23**, 271—295).—Experiments on seven persons confirm Marés' statement that, during the period of increased nitrogen excretion that follows a meal, the rise in uric acid has a shorter duration than that of urea, and occurs in the earlier hours of this period. This is difficult to reconcile with the view that the acid originates from the nuclein of the diet, on which the earlier stages of digestion have only a minimal effect.

The chief evidence in favour of the view that nucleins play a *rôle* as precursors of uric acid is based upon the results of thymus feeding. The present experiments show that extracts may be prepared from this gland which contain only traces of nuclein and nucleic acid, but when injected they produce a large excretion of uric acid. It therefore appears that some more soluble constituent of the diet acts either as a direct precursor or as a factor in a synthetic process.

W. D. H.

Dichlorothymolglycuronic Acid. By K. KATSUYAMA and S. HATA (*Ber.*, 1898, **31**, 2583—2585).—Rabbits were fed with thymol and their urine treated with hydrochloric acid and sodium hypochlorite (Blum, *Zeit. physiol. Chem.*, 1895, **16**, 514). In this way, a product was eventually obtained which was identical with Blum's dichlorothymolglycuronic acid, except that it melted at 118° instead of 125—126°. Its *barium* salt, $(C_{16}H_{21}Cl_2O_8)_2Ba$, was prepared and analysed; when boiled with dilute sulphuric acid, the acid gave glycuronic acid and a substance containing chlorine.

Rabbits, then, like men and unlike dogs, excrete thymolglycuronic acid; they are able to bring about a combination of thymol with the glycuronic acid of their bodies.

C. F. B.

Excretion of Kynurenic Acid. By LAFAYETTE B. MENDEL and HOLMES C. JACKSON (*Amer. J. Physiol.*, 1898, **2**, 1—28).—The experiments made on dogs, which are recorded, gave the following results. Kynurenic acid is a direct product of proteid katabolism, and as Baumann indicated, it does not originate as the result of putrefaction in the intestines. Its amount in the urine rises with proteid katabolism, whether this is produced by starvation, excess of proteid food, or the drugs borax and phloridzin; gelatin and carbohydrates do not act in this way. In conditions of nitrogenous equilibrium, or under the influence of proteid-sparing foods, the excretion of the acid is diminished or absent.

Uric acid and kynurenic acid may occur together in dog's urine, as Solomin found. Kynurenic acid was not found in the urine of cats and rabbits.

The observations suggest the presence of a quinoline-like radicle in the proteid molecule; the existence of a large carbohydrate group is also confirmed.

W. D. H.

Modification of Rigor Mortis by Fatigue. By CAROLINE W. LATIMER (*Amer. J. Physiol.*, 1898, **2**, 29—46).—After prolonged fatigue from electrical stimulation, the muscles of cold-blooded animals enter into rigor much earlier, and shorten much less than when not fatigued.

This is not due to increase of lactic acid, of carbonic anhydride, or other fatigue products, or to the abstraction of calcium salts, but to the exhaustion of the glycogen normally present in muscle, for the circulation through the exhausted muscle of a liquid containing dextrose in the proportion normally present in the blood effects a more or less complete restoration of the normal rigor. W. H. D.

Chemistry of Vegetable Physiology and Agriculture.

Action of Oxygen on Beer Yeast. By JEAN EFFRONT (*Compt. rend.*, 1898, **127**, 326—327).—When pressed beer yeast is exposed to the air, it absorbs oxygen with considerable development of heat, and with 2 kilos. of yeast in layers 37 cm. high, the temperature rises from 20° to 56°. This fact may be utilised for the detection of oxygen in a mixture of gases; the gas to be examined is passed very slowly through a mixture of yeast and pumice in which a thermometer is embedded, and the presence of oxygen is indicated by a rise of temperature.

The phenomenon is due to the presence in the cellules of an oxidising enzyme, which will be described subsequently. C. H. B.

Poisonous Effects of Cupric Salts on Higher Plants. By HENRI COUPIN (*Compt. rend.*, 1898, **127**, 400—401).—Experiments on young wheat plants lead to the following *toxic equivalents*, which represent the minimum quantity of the salt that must be dissolved in 100 parts of water in order to kill the plants: cupric bromide, 0·004875; chloride, 0·005000; sulphate, 0·005555; acetate, 0·005714; nitrate, 0·006102. It seems clear that the toxic effect is due to the copper ion, and that the electronegative radicle is practically without influence.

It follows from these results that the use of *solutions* of cupric salts as germicides is attended with considerable risk. C. H. B.

Composition and Feeding Value of Millet. By BALLAND (*Compt. rend.*, 1898, **127**, 239—240).—The term *millet* is applied commercially to grains derived from several different plants. Common or paniculated millet forms brilliant, ovoid, white, yellow, red, or black grains, which weigh from 4·60 to 5·90 grams per 1000. It has been grown from pre-historic times in middle Europe, Egypt, and Asia. Awmed millet, or *panic* millet, which is sometimes erroneously described as *Panicum italicum*, forms small, round, straw-coloured grains, 1000 of which weigh about 2·65 grams. Like common millet, it has been grown in temperate climates and used as human food since pre-historic times. Long millet forms elongated, greyish-yellow grains, with a smooth, highly lustrous envelope; they are much larger than the grains of common millet, and 1000 weigh 7·0 to 8·2 grams.

Like maize, millet is rich in fat and nitrogen, and is physiologically a more complete food than wheat; whilst millet contains less cellulose than African millets, and the latter contain more nitrogen. A number of millets from Africa, France, Italy, and Turkey were found to show the following extremes of composition. Water, 10·10 to 13·00; nitrogenous compounds, 8·98 to 15·04; fats, 2·20 to 7·30; sugar and starches, 57·06 to 66·33; cellulose, 3·00 to 10·23; ash, 1·40 to 6·00 per cent.; acidity, 0·055 to 0·098 per cent. C. H. B.

Phosphoric Acid dissolved by the Water in Soils. By TH. SCHLOESING, Jun. (*Compt. rend.*, 1898, **127**, 236—239 and 327—329).—The quantity of phosphoric acid dissolved in the water impregnating soils is usually about 1 milligram per litre, but sometimes is as much as 2 or 3 milligrams. Estimation of the phosphoric acid in the water displaced from various soils by the method of Schloesing, sen., shows that the proportion of phosphoric acid in solution depends on the nature of the soil, but is independent of the proportion of water in the soil. The quantity of phosphoric acid that remains in solution is the result of equilibrium between complex reactions, some of which tend to withdraw the acid from the solution, and, in most cases, the quantity dissolved is very small compared with the total quantity in the soil. It follows that, as fast as the dissolved acid is removed by vegetation, a corresponding quantity passes into solution from the soil, and hence, although the quantity dissolved at any particular instant is small, the total quantity brought to the roots of a plant during its life-time may be considerable.

The method of displacement involves the use of large quantities of soil and has other inconveniences, and in most cases the quantity of dissolved phosphoric acid can be estimated more quickly and easily. Agitation with water for 10 hours is quite sufficient to ensure the dissolution of the maximum proportion of phosphoric acid, and it is not advisable to agitate for a longer time, because secondary reactions may cause the reprecipitation of part of the acid. Further, although the proportion of acid dissolved increases with the ratio of soil to water, the increase is practically negligible if the proportion of dry soil is not less than 300 grams to 1300 c.c. of water. It is advisable, therefore, to take soil and water in these proportions. Carbonic anhydride has no influence on the result, provided that it is not in excess with respect to the calcium carbonate present. C. H. B.

Constitution of Natural Humoid Substances. By GUSTAVE ANDRÉ (*Compt. rend.*, 1898, **127**, 414—417).—The author has subjected various soils to the action of dilute acids and alkalis, with a view to throw light on the constitution of the nitrogenous organic matter that they contain. The soils were a cultivated soil, moorland soil, leaf-mould, and peat, and they were heated at 100° for 15 hours with potassium hydroxide or hydrochloric acid in quantity equal to twenty times the weight of the total nitrogen present, the acid or alkali being diluted with thirty times its weight of water. The nitrogenous matter insoluble in the alkali was afterwards treated with the acid, and *vice versâ*. In the case of the alkali, the author estimated the nitrogen in four distinct forms, (1) evolved as ammonia, (2) insoluble in alkali, (3) soluble in alkali and not precipitated by acids, (4) soluble in alkali and reprecipitated by acids. After treatment with the acid, he estimated the nitrogen (1) insoluble in acid, (2) existing as ammonia, (3) existing as amides. The results are given in tabular form.

The peat and the cultivated soil, when treated with alkali, yield a larger proportion of their nitrogen in the form of ammonia than the moorland soil or vegetable mould. The percentage of total nitrogen rendered soluble by the alkali is: peat, 79·19; cultivated soil, 76·92; moorland soil, 74·84; leaf-mould, 72·95, but the soluble nitrogen not precipitated by acid is higher in the cultivated soil and leaf-mould than in the other two. On the other hand, the percentage of total nitrogen rendered soluble by hydrochloric acid is: cultivated soil, 61·52; moorland soil, 61·70; peat, 53·91; leaf-mould, 39·34; and the proportion of ammoniacal nitrogen obtained is lower than when treated with alkali.

The different order in which the soils arrange themselves when treated by different reagents indicates that their nitrogenous matters differ in constitution. C. H. B.

Action of Calcium Oxide and Carbonate on certain Humoid Substances. By GUSTAVE ANDRÉ (*Compt. rend.*, 1898, **127**, 446—448).—The four soils used in experiments with dilute acid and alkali (preceding abstract) were heated at 100° for 15 hours with calcium oxide, calcium carbonate, or water only, and the nitrogen volatilised and the nitrogen rendered soluble were determined. The soils were also allowed to remain in contact with calcium oxide at the ordinary temperature for 82 days, with occasional agitation. The results are stated in the form of a table.

The quantity of ammonia liberated by the action of calcium oxide at 100° is considerable, but is lower than that liberated by potassium hydroxide. Calcium carbonate, and even water alone, cause the liberation of ammonia from all the soils, and in the case of the cultivated soil and peat the quantity is not negligible. The cultivated soil is more completely attacked than the other three by calcium oxide at 100°, and this is true also of calcium carbonate at 100°.

The quantity of nitrogen converted into ammoniacal nitrogen by the action of calcium oxide at the ordinary temperature amounts to from 5 to 6 per cent. of the total nitrogen in all four cases, and this indicates that the nitrogen of the amides in the soil is partially converted into ammoniacal nitrogen under the conditions specified, whatever may be the nature of the original nitrogenous matter.

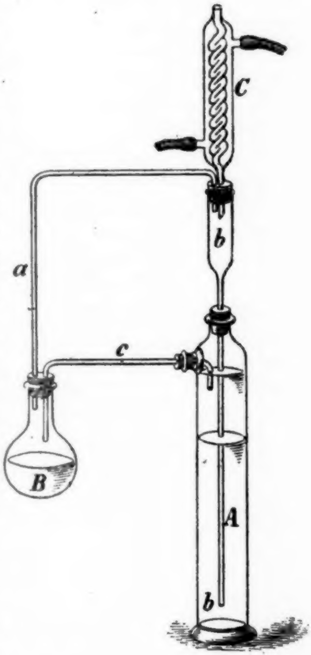
C. H. B.

Nitrogenous Substances accompanying Humic Acid in the Soil. By FAUSTO SESTINI (*L'Orosi*, 1898, **21**, 1—6).—The humic acid extracted from soil always contains notable quantities of nitrogenous substances, other than ammonia, which are more or less completely removed when the crude substance is purified by repeated dissolution in alkalis and reprecipitation with hydrochloric acid. These impurities are readily decomposed by concentrated alkalis, but on boiling crude humic acid with 2 per cent. sodium hydroxide solution for 13½ hours little more than half the nitrogen is expelled as ammonia. Dilute hydrochloric acid effects no sensible decomposition, and only a relatively small amount of ammonia is formed by boiling with 10 per cent. hydrochloric acid for 24 hours. It is concluded from these results that the nitrogen accompanying humic acid does not exist, to any large extent, in the form of amides. Experiments on the action of nitrous acid indicate the presence of appreciable amounts of amido-acids, but this question is reserved for further study. Previous observations by the author on the production of furfuraldehyde by the action of hydrochloric acid on humic acid have led him to suppose that the nitrogenous substances accompanying the latter might contain a pentosan residue. It is now found that furfuraldehyde is yielded, not only by crude humic acid, but also by the purified product, and, although to a less extent, by the humous substances formed by the action of mineral acids on pure sugar. N. L.

Analytical Chemistry.

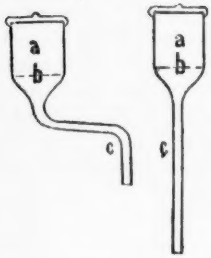
Extraction of Liquids. By OTTO FOERSTER (*Chem. Zeit.*, 1898, **22**, 421—422).—The apparatus is intended for the extraction of unsaponifiable matter from soapy liquids.

The soap solution, which should be nearly free from alcohol and measure about 600 c.c., is introduced into the detached cylinder *A*, 300 c.c. of ether is added, the stoppers are put in, and the whole is thoroughly shaken. When the two layers have separated, the stoppers are removed and well rinsed with ether; the top part of the cylinder is also rinsed. The other parts of the apparatus are then connected. *B* is a distilling flask of 200—300 c.c. capacity, partially filled with ether, and furnished with a cork having two perforations, the flask being heated by hot water. The ether vapour passes through the tube *a* into *b*, and when condensed in *C* runs through *b* to nearly the bottom of *A*, and then ascending, gradually increases the volume of ether until it overflows into the flask *B* by means of the syphon tube *c*.



The extraction is complete within 4 hours. As soap is not quite insoluble in ether, this must be afterwards shaken four times in succession with a little water to remove the soap. In order to ascertain the accuracy of the process, 1 gram of cholesterol was added to a solution of soap previously extracted with ether and 0·9997 gram was recovered.

L. DE K.



A New Form of Crucible. The Tube Crucible. By ERNST MURMANN (*Monatsh.*, 1898, **19**, 403).—The bottom (*b*) of this crucible is perforated and furnished with a straight (*c*) or bent (*c*,) tube, which serves the twofold purpose of conducting away a liquid from a precipitate or allowing the passage of a gas over the precipitate while the crucible is heated. The retention of the precipitate is provided for by placing a layer of asbestos between the bottom of the crucible and a sieve-plate which is of somewhat smaller size.

The crucible may be used in the estimation of many metals, and is of especial advantage in the case of the estimation of zinc or manganese as sulphide (see this vol., ii, 126).

A. L.

Quantitative Separation of Halogens. By RALPH S. SWINTON (*Pharm. J.*, 1898, **59**, 562—564).—The amount of iodine in any mixture of soluble haloid salts is determined by successively adding to an aqueous solution, containing a known quantity of the mixture, strong sulphuric acid, phenol, and bromine water. The mixture is thoroughly agitated and then extracted with chloroform, which removes the liberated iodine. This treatment is repeated in order to decompose all the iodide present; in each case, the excess of bromine combines with the phenol to form tribromophenol. The chloroform extract is mixed with water, and titrated with sodium thiosulphate in the usual manner.

In the absence of iodides, the amount of bromine present in a mixture is obtained by agitating its solution in cold sulphuric acid with potassium permanganate and chloroform. The solution of bromine in chloroform is added to alcoholic potassium iodide; the amount of iodine set free and estimated by thiosulphate is a measure of the bromine originally present in the solution.

Three determinations are required in order to ascertain the amount of chlorine, bromine, and iodine in a mixture of the haloid salts. The iodine is determined in one portion by the method described above. From another portion, the iodine is liberated by means of the calculated amount of N/2 potassium permanganate and extracted by chloroform; the bromine is then liberated by the addition of excess of permanganate, and its solution in chloroform mixed with alcoholic potassium iodide, to which the chloroform extract of iodine is subsequently added, and the whole diluted with water and titrated with thiosulphate. Lastly, a portion of the original mixture is titrated with standard silver nitrate solution, using potassium chromate as indicator.

These three determinations furnish sufficient data for the estimation of the halogens in any mixture of their salts.

G. T. M.

Quantitative Electrolytic Separation of Chlorine, Bromine, and Iodine. By H. Speketer (*Zeit. Elektrochem.*, 1898, **4**, 539).—When a normal solution of hydriodic acid is electrolysed with a silver anode and a platinum cathode, silver iodide is formed, and hydrogen eliminated with an E.M.F. of −0·06 volt, hydrobromic acid requires +0·15 volt, and hydrochloric acid 0·3 volt. More dilute solutions require greater E.M.F.'s. Oxygen must be absent otherwise the combination develops an E.M.F. of more than 1 volt, and all the halogens separate out. The silver employed must be pure. In practice, a solution in normal sulphuric acid is used and an anode of pure silver gauze, the electrolysis being conducted in a current of hydrogen. With 0·13 volt, the iodine is almost completely separated as silver iodide which adheres firmly to the anode, and may be washed and weighed together with it; 0·35 volt separates bromine in the same way, the chlorine remaining being titrated as usual. The greater part of the results given are accurate to within 0·5 per cent.

T. E.

Application of Phloroglucin-vanillin for the Detection of Sulphur and Nitrogen in Organic Compounds. By P. N. Raikow (*Chem. Zeit.*, 1898, **22**, 377—379).—The author (this vol., ii, 52) finds that an ethereal solution of phloroglucinol-vanillin not only readily detects halogens in organic compounds, but that it is also an excellent reagent for the detection of organic sulphur and some forms of organic nitrogen.

To detect sulphur in commercial oils, an open glass tube is bent at right angles near one end, a few drops of the oil are introduced at the bend, a wick of long-fibre asbestos is then introduced, and the oil is burnt, oils which give off much soot being diluted with alcohol or ether; the products of combustion are allowed to act on a porcelain crucible lid moistened with the reagent. In the presence of sulphur, sulphuric acid is formed which gives a characteristic red spot. A yellow spot is obtained by the combustion of amines, hydrazines, and similar nitrogenous compounds, and if halogens or sulphur should also be present, both kinds of spots are visible. This is the case with such substances as wool, hair, goose-feathers, casein, and artificial products such as thiocarbamide, sulphanilic acid, magenta, methyl-violet, &c.

L. de K.

Colour Reaction of Anhydrosulphuric Acid. By Etienne Barral (*Bull. Soc. Chim.*, 1897, [iii], **17**, 744—745).—Hexachlorobenzene paradichloride slowly dissolves in sulphuric acid containing anhydrosulphuric acid, with the production of a fine, red-violet coloration. The reaction is not given by dry sulphuric anhydride, but, on exposure to a moist atmosphere, the coloration quickly appears, and is finally destroyed when sufficient water or dilute sulphuric acid is added to convert the whole of the sulphuric anhydride present into ordinary sulphuric acid. The colour changes are sufficiently sharp to admit of the volumetric estimation of anhydrosulphuric acid by titration with dilute sulphuric acid of known strength. In the case, however, of commercial Nordhausen sulphuric acid, which is usually more or less coloured, the end-point is somewhat obscure, and the results are wanting in accuracy. N. L.

Detection of Sulphides, Sulphites, Sulphates, and Thiosulphates in the presence of each other. By Philip E. Browning and Ernest Howe (*Amer. J. Sci.*, 1898, [iv], **6**, 317—322; and *Zeit. anorg. Chem.*, **18**, 371—377).—This is a modification of the scheme recommended by Greig Smith (Abstr., 1896, ii, 71). To about 0·1 gram of the mixture, dissolved in 10 c.c. of water, ammonia is added until distinctly alkaline, the sulphide is then precipitated with zinc acetate, and the precipitate is further examined. The filtrate is slightly acidified with acetic acid, any sulphate is precipitated by barium chloride, the solution filtered, and the filtrate mixed with a very slight excess of iodine; stannous chloride is added until the colour of the iodine disappears, and then a few drops of hydrochloric acid; a precipitate proves the presence of a sulphite. The filtrate from this is mixed with excess of bromine water, and stannous chloride is added until the liquid is decolorised; a precipitate indicates the presence of a thiosulphate. L. de K.

Modifications of Kjeldahl's Process. By Albert Atterberg (*Chem. Zeit.*, 1898, **22**, 505—506).—The author heats 0·5 gram of the nitrogenous compound with 20 c.c. of strong sulphuric acid and a drop of mercury, and, when frothing has ceased, 15 to 18 grams of potassium sulphate is added; the liquid is generally colourless after 30 minutes boiling, but it is advisable to boil for another 15 minutes. Treated in this manner, even quinine yields the whole of its nitrogen in the form of ammonia.

Attempts to replace the mercury by other metals or oxides were not quite successful. Phosphoric anhydride has no advantage over potassium sulphate. Molybdic acid acts energetically, but, on account of the blue colour of the solution, it is difficult to observe the end reaction. L. de K.

Estimation of Arsenic in Antimony and in Metals. By O. Ducru (*Compt. rend.*, 1898, **127**, 227—229).—About 5 grams of the coarsely powdered substance is distilled with 100 c.c. of ferric chloride solution and 200 c.c. of concentrated hydrochloric acid until 100 c.c. has passed over. A further quantity of 100 c.c. of hydrochloric acid is then added, and a second 100 c.c. distilled off, after which the same treatment is repeated, so that the total volume of the distillate is 300 c.c. The end of the condenser tube should dip into the distillate, and about 50 c.c. of water should be placed in the receiver at the beginning of the operation.

The distillate contains a little antimony, and must therefore be redistilled until about 300 c.c. has passed over. If 50 to 100 c.c. of concentrated sulphuric acid is added before redistilling, it is usually sufficient to collect 150 c.c. The arsenic in the final distillate is precipitated with hydrogen sulphide in the usual way.

The ferric chloride solution is prepared by allowing 2000 c.c. of hydrochloric acid and 2000 c.c. of water to act on 800 grams of French nails, and, after all action has ceased, the liquid is saturated with hydrogen sulphide and filtered. The excess of hydrogen sulphide is expelled by boiling, and a current of chlorine is passed into the liquid until all the iron is oxidised. The excess of chlorine is afterwards expelled by means of a current of air, and the liquid is diluted to 5000 c.c. by adding concentrated hydrochloric acid. The solution should be examined for arsenic by distilling some of it, after adding 15 grams of ferrous sulphate free from arsenic.

The method is applicable to many metals, such as iron, steel, lead, tin, zinc, and alloys, as well as to antimony. C. H. B.

Methods for Estimating Potassium, and the Best Precipitants of Platinum. By ALBERT ATTERBERG (*Chem. Zeit.*, 1898, **22**, 522—523; 538—539).—It is admitted that, instead of weighing the potassium platinochloride, it is better to dissolve the compound in boiling water and to reduce the platinum by suitable means; the metal is then collected, weighed, and calculated to potassium. For this purpose, the author prefers using magnesium ribbon, the excess of which may be readily removed by hydrochloric acid. If the amount of platinum is very small, thioacetic acid is recommended.

When potassium is separated from sodium, the latter is left in the alcoholic filtrate containing also the excess of platinum chloride. If it be desired to directly estimate the sodium, the author recommends removing the platinum by means of metallic mercury at the boiling temperature. The liquid then contains some mercuric chloride, which is readily separated from the sodium chloride by heating the dry residue.

To avoid the tedious separation of iron or aluminium before treating the sample with platinum chloride, the author recommends adding some citric acid; the acid citrates of iron and aluminium are readily removed by washing with alcohol. L. DE K.

Electrolytic Deposition of Silver from Solutions in Nitric Acid.—By FRIEDRICH W. KÜSTER and H. VON. STEINWEHR (*Zeit. Elektrochem.*, 1898, **4**, 451).—The authors have experienced great difficulty in obtaining a smooth deposit of silver from solutions of the nitrate by the processes hitherto prescribed; a spongy deposit was almost invariably formed after some time. In all these cases, they attempted to work with the prescribed constant current, the result being that, as the amount of silver in the solution diminished, the E.M.F. required increased. A very large number of experiments were then carried out in which the E.M.F. was kept constant and the current allowed to vary. The formation of silver peroxide is easily prevented by the addition of a little alcohol. The result finally arrived at is that a perfect deposit of silver may be obtained with certainty by adding 1 to 2 c.c. of nitric acid of sp. gr. = 1·4 and 5 c.c. of alcohol to the solution, and electrolysing at 55° to 60° with a constant E.M.F. of 1·35 to 1·38 volts. With 1·4 volts or more, the deposit becomes spongy, even when the other precautions are taken. As much as 2 grams of silver may be deposited. The constant E.M.F. was obtained by short-circuiting a Gülcher thermo-battery by a resistance small enough to reduce its E.M.F. to the desired value. The terminals of the electrolytic cell are then connected to those of the battery. The usual plan of putting a resistance in series with the electrolytic cell so as to reduce the E.M.F. between the electrodes to the desired value is unsuitable because, as the electrolysis progresses, the resistance of the cell increases, and with it the E.M.F. Test analyses of a silver coin carried out by the method described, gave results varying from 89·75 to 89·83 per cent. of silver, the mean, 89·79, being practically identical with the mean of two very careful gravimetric determinations (89·789). T. E.

Estimation of Zinc and Manganese as Sulphides. By Ernst Murmann (*Monatsh.*, 1898, **19**, 404—405).—The estimation of zinc and manganese as sulphides is not in general use, owing to the difficulty of obtaining a clear filtrate and the lengthy washing which is necessary. The author avoids these difficulties by precipitating the sulphides in presence of mercuric chloride, when the mercuric sulphide which is formed largely increases the bulk and conspicuousness of the precipitate and renders it more easy to filter and wash. The precipitate is collected in a "tube-crucible" (see this vol., ii, p. 122) and heated in a stream of hydrogen as usual, when the mercuric sulphide is completely volatilised.

The same method may be employed in the case of stannic hydrate, and is probably applicable to other precipitates. A. L.

Note.—Lowe has shown that there is no difficulty in the filtration of zinc sulphide if the precipitation is effected with the proper precautions (Abstr., 1893, ii, 302). Editors.

Electrolytic Separation of Cadmium and Iron. By Willem Stortenbeker (*Zeit. Elektrochem.*, 1898, **4**, 409).—The mixture of cadmium and iron salts is dissolved in 100 c.c. of water, and, if more than a trace of ferric salt is present, reduced by adding about five times the requisite quantity of sodium sulphite to the slightly acid solution and warming. Two or three grams of pure potassium cyanide are now added, and the solution warmed until it takes the yellow colour of potassium ferrocyanide; it is then diluted to 200—250 c.c., and electrolysed overnight at the ordinary temperature with 0·05 to 0·1 ampère per sq. dcm. The results are excellent.

T. E.

Electrolytic Separation of Copper from Silver, Mercury, and Arsenic. By N. Revay (*Zeit. Elektrochem.*, 1898, **4**, 313 and 329).—*Copper and Silver.*—In order to decompose a solution of silver nitrate, an E.M.F. of about 0·9 volt is needed, whilst for copper nitrate the value is approximately 1·4 volts; when a solution containing silver and copper nitrates is electrolysed at about 70° with from 1·3 to 1·4 volts, the silver is deposited, the copper remaining in solution. The deposit obtained is not quite smooth, but adheres sufficiently well to the platinum dish to allow of its being washed; at lower temperatures, this is not the case. The solution must be strongly acidified with nitric acid in order to prevent the formation of silver peroxide. In presence of potassium cyanide, the cathodic polarisation, both of silver and copper, is much higher than in acid solution, owing to the smaller number of ions present. It also increases as the concentration of the metal diminishes, so that, from solutions containing much copper and little silver, the former may be more readily deposited than the latter. At 45—60°, however, with 1·65—1·8 volts, the author obtains very satisfactory results, the deposit of silver being smooth and adherent.

Copper and Mercury.—The E.M.F. required to deposit mercury is almost the same as that required for silver under similar circumstances. From acid solutions of copper sulphate and mercuric chloride, deposits of mercury, apparently contaminated with mercurous salts, were thrown down, and no results of value were obtained with solutions of mercurous nitrate in presence of nitric acid. In solutions containing potassium cyanide, mercury behaves in much the same way as silver. When the concentration of the mercury falls below about 1/384 normal, potassium is more easily separated at the cathode than mercury, and hydrogen is therefore evolved. When the concentration of the copper is not too great, however, a satisfactory separation is possible, using 1·8—1·95 volts at the ordinary temperature. In the experiments quoted, 0·5 to 0·6 gram of crystallised copper sulphate was mixed with 3 grams of potassium cyanide, and from 0·25 to 1·0 gram of mercuric chloride; the mercury found was 0·1 to 0·2 per cent. too low.

Copper and Arsenic.—From solutions of copper sulphate and potassium arsenate acidified with sulphuric acid, the copper is readily deposited in a pure state by 1·6 to 1·8 volts in 16 to 24 hours. The separation is also a good one in ammoniacal solution, 9 to 20 hours being required with 1·65 to 1·8 volts. T. E.

Separation of Nickel from Cobalt by Hydrogen Chloride. By Franke S. Havens (*Zeit. anorg. Chem.*, 1898, **18**, 378—381).—The method described by E. Piñerúa (Abstr., 1897, ii, 387) which is based on the insolubility of nickel chloride in ether saturated with hydrogen chloride is not accurate. Piñerúa precipitates the nickel chloride in a mixture of equal parts of concentrated hydrochloric acid and dry ether saturated with hydrogen chloride, but the author finds that 14 c.c. of such a solution contains 0·002 gram of metallic nickel. An accurate separation of nickel and cobalt chlorides can be effected by a modification of this method, provided that only a few centigrams of cobalt chloride are present, but when more cobalt chloride is present, the nickel chloride always carries down with it an appreciable quantity of cobalt which cannot be washed out of the precipitate with ether saturated with hydrogen chloride. The separation is carried out as follows. The solution of the chlorides is evaporated to dryness, dissolved in the smallest possible quantity of water (about 1 c.c.) 10—15 c.c. of dry ether added, and the cooled solution saturated with hydrogen chloride. The precipitate formed is washed with ether saturated with hydrogen chloride, and the nickel in the precipitate and the cobalt in the filtrate are then estimated by electrolysis. It is probable that, in the presence of larger quantities of cobalt, a complete separation could be obtained by repeated precipitation of the nickel chloride.

E. C. R.

Electrolytic Separation of Cobalt and Nickel. By Alfred Coehn (*Zeit. Elektrochem.*, 1898, **4**, 501).—The author shows that electro-stenolysis occurs in the following cases: (*a*) the negative radicle separated at the anode does not act on the metal deposited at the cathode; (*b*) insoluble compounds such as peroxides are formed at the anode; (*c*) the radicle separated at the anode combines with the solution, as, for example, in a solution of cuprous chloride. He has observed that the cobalt salts exhibit stenolysis, whilst those of nickel do not; the difference is due to the deposition of cobaltic oxide at the anode, nickel salts giving no such deposit; this behaviour may be utilised for the separation of the metals. The electrolysis is carried out in neutral solution, copper sulphate being added in order to prevent the deposition of part of the cobalt at the cathode. T. E.

Estimation of Manganese as Pyrophosphate. By FRANK A. GOOCH and MARTHA AUSTIN (*Amer. J. Sci.*, 1898, **6**, 233—243, and *Zeit. anorg. Chem.*, **18**, 339—351).—The accuracy of this process depends a good deal on the amount of ammonium salts and free ammonia present, and the authors, after a lengthy investigation, now propose the following process. The liquid, which should be slightly acid and contain an amount of maganese not exceeding that which would produce 0·4 gram of pyrophosphate, is diluted to 200 c.c., and 20 grams of ammonium chloride and 10 c.c. of a cold saturated solution of sodium ammonium phosphate are added. After adding dilute ammonia in very slight excess, the mixture is heated until the precipitate which is formed becomes silky and crystalline; after being allowed to cool for half an hour, the precipitate is collected on a Gooch's crucible, washed with slightly ammoniacal water, dried, ignited, and weighed as pyrophosphate. L. DE K.

Estimation of Oxide of Iron and Alumina in Phosphates. By N. BLATTNER and J. BRASSEUR (*Bull. Soc. Chim.*, 1897, [iii], **17**, 760—761).—A critical examination of the methods commonly employed for the estimation of oxide of iron and alumina in phosphates has led the authors to the following conclusions. The acetic method, as modified by Maret and Delattre, should be rejected as giving low results, since a portion of the alumina always remains in solution. Glaser's method is rapid, easy of execution, and gives sufficiently accurate results in the case of phosphates free from manganese. The method involving the use of caustic soda gives very accurate results when all the precautions described by Lasne are duly observed. The results obtained by Gruber's method, a simplification of the preceding, are inexact. Gladding's method only differs in detail from that of Lasne, caustic potash being substituted for caustic soda. The method of direct precipitation by ammonia, as carried out by Thomson, gives variable results, according to the nature of the phosphate under examination, and the precipitate always contains lime. N. L.

Technical Examination of Ferruginous Pigments. By H. BAUCKE (*Zeit. anal. Chem.*, 1898, **37**, 668—679).—The ferruginous pigments prepared by roasting ochres exhibit a gradation of shades ranging from yellowish-brown to deep purple, the depth of colour increasing with the temperature and duration of the roasting. Even in the most strongly heated specimens, the ferric oxide is practically all soluble in concentrated hydrochloric acid, and digestion with that acid furnishes the most convenient means of dissolving the iron for estimation. The specific gravity of the substance increases with the depth of colour, being 3·484 in those most feebly roasted, and 4·462 in those most strongly heated ; the passage from pale brown to red is accompanied by the most marked increase in specific gravity. As these pigments are largely used for painting iron-work, especially on railways, the degree in which they resist the action of the acids in coal smoke is of importance. The degree of resistance increases with the temperature of roasting, and comparative experiments on this point may conveniently be made by boiling the samples with excess of 1 per cent. sulphuric acid for a determined time (1 hour). The percentage of the total iron dissolved by this method is quite independent of the size of the particles, fractions exhibiting, under the microscope, diameters of 4—10 μ, giving up to the acid the same percentage as those of 30 μ and higher. M. J. S.

Analysis of Molybdenum Compounds. By HARRY BREARLEY (*Chem. News*, 1898, **78**, 203—205).—Chatard's process for the estimation of molybdenum by precipitation with lead acetate is accurate in neutral solution, but even if the solution is faintly alkaline decomposition of any excess of lead acetate ensues with deleterious effects ; in the presence of 2 c.c. of free 33 per cent. acetic acid per 250 c.c., the results again are accurate, whereas with more free acid the precipitate loses its granular character, becomes powdery, and liable to pass through the filter. Excess of lead acetate may be detrimental in neutral or alkaline solutions, but is not so in acid solutions ; in fact, water slightly acidified with acetic acid and holding, per litre, 2 c.c. of a solution of lead acetate (containing 7·896 grams per litre) may be used towards the end of a washing with pure hot water to prevent the formation of opalescent filtrates. To ignite the precipitate, it need not be removed from the paper, but the whole may be folded wet and dried in a crucible in the front of a muffle ; ignition should be started at as low a temperature as possible to prevent the formation of imperfectly decarbonised patches that would require a dangerously high temperature to burn away ; lead molybdate may, however, be exposed for hours at a temperature between 850° and 900° without suffering a greater loss than 1 per cent. The result is, moreover, either not affected at all, or, at any rate, not beyond + or − 1 per cent., by the presence of 0·1 or 0·2 gram of the following substances: sodium chloride or nitrate ; ammonium chloride, nitrate, or acetate ; manganese ; copper ; cobalt ; nickel ; zinc ; magnesium ; mercuric mercury ; but uranium causes a difference of 1·7 or 1·5 per cent. The presence of ammonium acetate makes the precipitate powdery ; copper and manganese darken the ignited precipitate, although the colour can be nearly removed by treatment with nitric acid and lead peroxide. Cobalt renders the ignited precipitate greyish, and on dissolving in hydrochloric acid imparts a green colour to the solution which disappears on dilution ; 0·00005 gram of cobalt can be detected by this reaction, which, moreover, may probably prove useful in colorimetrically indicating the amount of cobalt present in the grey precipitate of lead molybdate.

In this and some other instances, redissolving the ignited lead molybdate precipitate in dilute hydrochloric acid, neutralising with ammonia, acidifying with acetic acid, and treating with a few additional drops of lead acetate, suffices to furnish a practically pure precipitate of lead molybdate. In the presence of zinc, molybdenum causes a cloudiness in the neutralised solution, which may be disregarded where it forms a mere opalescence on adding the excess of acetic acid, otherwise, when neutralising the hydrochloric acid, the final portions should be got rid of by means of ammonium acetate. Nickel exhibits this clouding effect to a lesser degree, mercury and uranium to a more marked extent; but in these cases, too, the warm, acidified solution may be cleared by adding ammonium acetate. Uranium colours the ignited precipitate yellowish-brown, and although it dissolves in hydrochloric acid, it needs repeated reprecipitations to remove the last traces of uranium from the lead molybdate.

Molybdenum may be estimated volumetrically by adding an excess of lead acetate, filtering off the lead molybdate, and determining the lead in the filtrate, or by Schindler's process, in which lead acetate is added to an acidified solution of a molybdate, until the latter ceases to give any coloration when mixed with tannin in a white cupped tile. This process is rapid, and gives approximate results; it may, however, be advantageously supplemented by filtering some of the liquid after the completion of the tannin reaction, and testing it, first with lead acetate, and, if necessary, with sodium molybdate; the intensity of any cloudiness indicates approximately the quantity of any unprecipitated molybdate or excess of lead, as the case may be, inasmuch as lead acetate gives a distinct cloudiness in solutions faintly but decidedly acid with acetic acid if they contain even as little as 1 part of molybdenum per 4,000,000. D. A. L.

Testing Otto of Roses. By P. N. Raikow (*Chem. Zeit.*, 1898, **22**, 523—524).—The author, in reply to Dietze (*Suddeutsche Apoth. Zeit.*, 1898, 174), states that the saponification number of the oil is but insignificantly increased when the sample has been previously filtered at 18°. As regards the solidifying point, he asks whether Dietze regards 15° or 20° as the limit of temperature.

An analysis is given of a sample which was undoubtedly genuine, but which would not satisfy Dietze's requirements: sp. gr. 0·855 at 27°/17·5°. Solidifying point, 20·5°; optical activity in a 100 mm. tube, 2° 45′ at 25°; acidity figure, 1·1; saponification number, 15·5; ether number, 14·4; and relation figure (Verhältnisszahl), 13.

L. de K.

Detection and Estimation of Methylic Alcohol in Ethylic Alcohol. By Auguste Trillat (*Compt. rend.*, 1898, **127**, 232—234).—When ethylic alcohol is oxidised with chromic mixture, it yields aldehyde, acetic acid, and acetal, whereas methylic alcohol, under the same conditions, yields acetic acid and methylal. When condensed with dimethylaniline, acetal yields the compound $CHMe(C_6H_4\cdot NMe)_2$, which has not previously been described, and methylal yields tetramethyldiamidodiphenylmethane, $CH_2(C_6H_4\cdot NMe_2)_2$, and this, when oxidised, gives an intense blue coloration, permanent when the liquid is heated. The acetal derivative, under the same conditions, yields an unstable blue compound which is decomposed on heating. When applying these facts to the detection of methylic alcohol in ethylic alcohol, precautions are necessary, because dimethylaniline often contains small quantities of methylic alcohol, and even of the base derived from methane, and also, when heated with certain acids in presence of air, it develops a blue coloration.

Twenty c.c. of the alcohol to be examined is diluted with 300 c.c. of water containing 30 grams of potassium dichromate in solution, and 100 c.c. of dilute sulphuric acid (1 : 5) is added. After standing for an hour at the ordinary temperature, the liquid is distilled, the first portions of the distillate being rejected, and the distillate is exactly neutralised with sodium hydroxide and redistilled almost to dryness. The second distillate is diluted to 400 c.c., and 100 c.c. is mixed with 2 c.c. of pure dimethylaniline and 1 c.c. of dilute sulphuric acid (1 : 10) and heated at 65—70° for 5 hours out of contact with the air. The liquid is made alkaline, the excess of dimethylaniline expelled by means of a current of steam, and the liquid, or part of it, acidified with acetic acid and mixed with lead peroxide suspended in water. The intensity of the blue colour produced is compared with that obtained with alcohol containing known percentages of methylic alcohol. It is well to make a blank experiment with pure ethylic alcohol. C. H. B.

Estimation of Glycerol in Sweet Wines. By GUIDO FABRIS (*L'Orosi*, 1897, **20**, 260—267).—The estimation of glycerol in wines containing much sugar presents special difficulties, and in the methods generally employed there is a loss of glycerol, which is not compensated for by the traces of sugar, colouring matter, &c., which are weighed with the latter. The German official method and that of Lecco, both of which involve the use of lime, give satisfactory results when certain precautions are observed; the following method of procedure is recommended.

Fifty c.c. of the wine is mixed with 5 grams of sand and 8—10 grams of calcium hydroxide, and the mixture evaporated to the consistency of a thin paste, which is then ground in a mortar and repeatedly extracted with hot alcohol of 96°, using 30—40 c.c. at each extraction. The filtered extract, which should amount to about 200 c.c., is evaporated to a syrupy consistence, and 10 c.c. of absolute alcohol and 15 c.c. of anhydrous ether gradually added; when the precipitate has subsided, the liquid is filtered, the filter washed with a mixture of alcohol and ether (2 : 3 vols.), the filtrate evaporated, and the residue dried for 1 hour at 100° and weighed. If the residue appears to be impure, it is redissolved in a mixture of 5 c.c. of alcohol with 7·5 c.c. of ether, filtered, evaporated, dried for half an hour at 100°, and weighed. Should more than 0·5 per cent. of glycerol be found, it is well to repeat the analysis with a smaller amount of the wine, so that the glycerol finally weighed may not exceed 0·3 gram. The isolation of larger quantities of glycerol is found to be accompanied by a more than proportionately greater loss. N. L.

Nitration of Glycerol with Nitrous Acids. By R. Auzenat (*Chem. News*, 1898, **78**, 258—259).—Glycerol, of sp. gr. = 1·262, was treated with 97 per cent. sulphuric acid and 94 per cent. nitric acid containing varying proportions of nitric peroxide. The nitroglycerols obtained were washed in the ordinary way with water, and, in addition, twice at 60° with equal volumes of a 4 per cent. solution of sodium carbonate, the alkali being finally removed with distilled water. These products were filtered and submitted to the heat test, and it was found that nitroglycerol satisfying this test can be prepared with nitric acid containing as much as 3 per cent. of nitric peroxide, although decomposition during the nitration frequently occurs with anything above 2 per cent. The presence of free sulphuric acid is not detected by the heat-test, although it is dangerous if the explosive has to be stored, but the test is effective in rejecting any nitroglycerol containing more than 0·003 per cent. of free nitric acid. Washing with sodium carbonate at a high temperature increases the stability. D. A. L.

Detection of Acetone. By Pasquale Malerba (*Zeit. anal. Chem.*, 1898, **37**, 690; from *Ann. Chim. Farm.*, **21**, 14).—On adding, drop by drop, a 1—2 per cent. solution of dimethylparaphenylenediamine to the suspected liquid, a red coloration gradually appears, and increases in intensity after some hours. Both alkalis and strong mineral acids change this colour to a bright violet. M. J. S.

Estimation of Formic Acid in the Presence of Acetic Acid and of Easily Oxidisable Substances. By Alexander Leys (*Chem. News*, 1898, **78**, 245—246).—When acetic acid containing formic acid is mixed with mercuric acetate, crystalline mercurous acetate forms in proportions exactly corresponding to the quantity of formic acid present. Dilute, 1 per cent., solutions are best for the reaction, which takes place at the ordinary temperature, but is expedited by heating, and is complete at the boiling point; it is, moreover, not affected by the presence of alcohol, acetic acid, or aldehyde. To estimate formic acid, the total acidity of the solution is first ascertained, and if much acetic acid is present, the solution is diluted to 20 or 30 per cent.; if, however, the proportion of formic acid to acetic acid is 1 to 20, or greater, the solution is diluted to 2 per cent. acidity. Ten c.c. of this is mixed with 20—30 c.c. of a 20 per cent. solution of mercuric acetate, and made up to 100; it is heated during 7 or 8 minutes up to the boiling point and allowed to cool overnight. The precipitate is collected on a glass wool filter, washed 4 or 5 times with alcohol of 95° containing 2 per cent. of glacial acetic acid, then 2 or 3 times with neutral alcohol of 95°, finally with dry ether to remove the alcohol. It is dried in the air or in a vacuum, dissolved in nitric acid diluted with an equal volume of water, mixed with sodium chloride and the mercurous chloride filtered, washed, dried at 100°, and weighed; the number obtained, multiplied by 0·0976, gives the corresponding weight of formic acid.

In mixtures of formic acid and alcohol, or of formic acid, alcohol and acetic acid in which the latter is not present in sufficient quantity, 2 c.c. of glacial acetic acid is added before the mercuric acetate.

D. A. L.

Estimation of Potassium Hydrogen Tartrate in Wines. By Henry Jay (*Bull. Soc. Chim.*, 1897, [iii], **17**, 626—629).—The author has examined both Berthelot and de Fleurieu's and Reboul's methods for estimating potassium hydrogen tartrate in wines. The former, which depends on the precipitation of the salt by the aid of alcohol, gives numbers somewhat too low, but may be rendered more accurate by suitable corrections. The results obtained by Reboul's method, which depends on evaporating down the wine and crystallising the salt, are much too high, as malates, &c., are also carried down with the tartrate.

J. J. S.

Microchemical Reactions. By Constantin Saint-Hilaire (*Zeit. physiol. Chem.*, 1898, **26**, 102—109).—In order to test microchemically for uric acid, the sections obtained from organs hardened in alcohol, and embedded in celloidin, are placed in a 5 to 10 per cent. solution of copper sulphate for some hours; the compound which uric acid forms with copper is then reduced by placing the sections for a few minutes in a boiling saturated solution of sodium hydrogen sulphite; after washing, the sections are finally treated with potassium ferrocyanide; concretions of uric acid are by this means coloured red.

In some preparations, the chromatin network of the nuclei was observed to be somewhat similarly stained, and it was found that the alloxuric bases, histon and protamine, are similarly affected. The constituent of the nucleus which gives the reaction is believed to be histon, combined as nucleo-histon. W. D. H.

Examination of Beeswax. By Karl Dieterich (*Zeit. anal. Chem.*, 1898, **37**, 699—700; from *Helfenberger Annalen*, 1897, 218), and by Georg Buchner (*ibid.*, 700; from *Zeit. öffent. Chem.*, 1897, **3**, 570).—For the estimation of the "saponification number" of a glyceride, it is recommended by Henriques to dissolve 3—4 grams of the substance in 25 c.c. of light petroleum, add an excess of alcoholic soda, and allow to remain in the cold until the next day; saponification is complete, and the results of this "cold saponification process" agree absolutely with those of saponification by heat, whilst, in some cases, such as mixtures of beeswax and ceresin, cold saponification is even more satisfactory than the usual method, provided that a petroleum is selected in which the substance is perfectly soluble. The author maintains that, with beeswax, cold saponification gives lower values than the hot method, and that the saponification number is more affected than the acid number.

Buchner ascribes these differences to the use of a petroleum having too low a boiling point (55—75° instead of 100—150°).

M. J. S.

New Colour Reaction for Phenylhydrazine. By Louis Simon (*Compt. rend.*, 1898, **126**, 483—485).—The addition of a few drops of an aqueous solution of sodium nitroprusside to a warm solution of phenylhydrazine and trimethylamine develops a blue coloration, the intensity of which is increased by subsequently adding a concentrated solution of potash. The coloration, although fugitive, is very intense, and serves to detect 1 part of phenylhydrazine in 50,000. The presence of alcohol, ether, or ammonia, is not detrimental, but chloroform, benzene, and acids hinder the production of the colour, whilst acetone gives its own characteristic red coloration. This reaction is limited to phenylhydrazine and to those derivatives which, like orthotolylhydrazine and 1 : 4-bromophenylhydrazine, are substituted in the aromatic nucleus; alkylic and acidyl derivatives of phenylhydrazine, hydrazones, semicarbazide, and hydrazine hydrate, under similar conditions, give no colour reactions of this nature.

G. T. M.

Estimation of Caffeine in Coffee. By E. Tassilly (*Bull. Soc. Chim.*, 1897, [iii], 17, 761—766 and 766—768).—The methods employed for the estimation of caffeine in coffee may be classed in three groups. 1. The coffee, with or without the addition of lime, magnesia, or ammonia, is extracted with warm chloroform. 2. The coffee is extracted with hot water and the solution shaken with chloroform, either directly or after evaporation with magnesia. 3. The coffee, with or without the addition of an alkali, is treated with a solution of sodium benzoate (Herlant) or salicylate (Gorges) and the liquid then extracted with chloroform. The methods of the first group give uncertain results, with the exception of that of Grandval and Lajoux, in which ammonia and ether are employed. Of the methods of the second group, those of Dvorkovitch and of Domergue and Nicolas give satisfactory results, and may be employed when time does not allow the use of the more accurate, but tedious, processes of Herlant and Gorges.

Since the complete desiccation of hydrated caffeine is somewhat troublesome, it is always preferable to weigh it after crystallisation from chloroform. In order to obtain a pure product, it is necessary to use an alkali in the extraction, and magnesia is to be preferred to lime, since the latter, in presence of water at 100°, causes decomposition of caffeine with liberation of ammonia. Some other slight modifications in the working of the various processes are suggested.

In the second paper, the author describes a new process, which is carried out as follows. Ten grams of the powdered sample is extracted five times with boiling water, 200 c.c. of the latter being used for each extraction. Half of the liquid thus obtained is evaporated to dryness, the residue made into a paste with 1—2 c.c. of 10 per cent. sulphuric acid, and thoroughly extracted with boiling water. The aqueous extract is then either (1) evaporated to dryness with 20 grams of sand and 2 grams of magnesia, and the caffeine extracted by digestion with warm chloroform, or (2) made alkaline with ammonia and repeatedly agitated with chloroform in the cold. The best results are obtained by the second mode of procedure, and the test analyses quoted are very satisfactory. N. L.

Artificial Coloration of Coffee. By Giulio Morpurgo (*L'Orosi*, 1897, 20, 397—403).—With the object of improving its appearance, coffee is frequently subjected to the processes of (1) washing with water to which antiseptics, such as boric acid, are often added; (2) colouring with mixtures of various substances, of which the most commonly used are graphite, bone black, soot, ultramarine, Berlin blue, lead chromate, iron tannate, yellow ochre, chalk, talc, and various aniline colours; (3) polishing with resin, wax, sandarach, talc, and similar substances.

The colour of the sample and its appearance when examined with a lens often afford indications of the treatment to which it has been subjected. The presence of resin is shown by the turbidity produced on adding water to the cold alcoholic extract. Wax may be extracted by heating with alcohol to which a little ether has been added. For the detection of colouring matters, 50 grams of the coffee is boiled for half an hour, first with alcohol alone, and then with alcohol rendered slightly alkaline with potash, and after the filtrates have been allowed to stand for some hours, the sediment is examined by microchemical methods. The treatment with alkaline alcohol removes those colouring matters, such as carbon and lead chromate, which adhere more closely to the seed. The lighter particles of vegetable matter may be separated by treating the sediment with chloroform and allowing the liquid to stand for 24 hours. N. L.

Method for Testing Natural and Artificial Organic Colours. By A. G. Rota (*Chem. Zeit.*, 1898, ii, 437—442).—The author has tabulated a scheme for the detection of organic dyes and separation of the same.

The chief reagent used is stannous chloride containing free hydrochloric acid, which reduces some colouring matters, but does not affect others. The separation of the colours is effected by ether, either in acid, neutral, or alkaline solution. Wool is also used to separate basic colours from acid compounds. L. de K.

Detection of Elderberry Juice in Extract of Ergot. By Italo Ceppellini (*L'Orosi*, 1898, 21, 47—48).—About 1 gram of the suspected extract is dissolved in 6 c.c. of water acidified with 30 drops of concentrated sulphuric acid, and the solution vigorously shaken with 10 c.c. of oil of turpentine; after half an hour, it is again shaken and passed through a filter previously moistened with oil of turpentine. If the extract is pure, the aqueous layer acquires the colour of sherry, whilst the oily layer remains colourless. If, however, not less than 10 per cent. of elderberry juice is present, the oil of turpentine acquires a more or less intense yellowish-green tint, and the aqueous layer is of a fuller wine-red colour. N. L.

Estimation of Tannin. By Léo Vignon (*Compt. rend.*, 1898, 127, 369—372).—Silk free from gum absorbs tannin readily and completely from solutions of tanning materials at 50°, but does not absorb gallic acid, glucose, &c. About 5 grams of silk is necessary for 0·1 gram of tannin dissolved in 100 c.c. of water. The tannin may be estimated by (*a*) the increase in the weight of the silk, (*b*) the difference in the proportion of solid matter in the solution before and after the treatment with silk, (*c*) by titration with permanganate. The last method is the most exact, but *b* is simple and expeditious, and gives results sufficiently exact for practical purposes.

The silk is prepared by boiling 20 grams of raw silk for 30 minutes with a solution of 50 grams of white soap dissolved in 500 c.c. of water, this treatment being repeated and the silk then well washed.

The tannin solution is prepared by treating in the usual way from 10 to 20 grams of the tanning material. One thousand c.c. of the solution should contain about 3 grams of tannin. Twenty-five c.c. of this solution is diluted to 250 c.c., and 100 c.c. of the diluted liquid is heated at 50° for 5 hours, but not more, with 5 grams of the prepared silk. Titration with permanganate and indigo, before and after the treatment with silk, is conducted in the usual way.

The results with sumach and oak galls are practically identical with those obtained by precipitating the tannin with cat-gut or ammoniacal zinc acetate, and the method is more expeditious. The special reagent (silk) is very readily prepared and is practically constant in composition. C. H. B.

A New Proteid Reaction. By J. H. Elliott (*J. Physiol.*, 1898, **23**, 296—300).—Dilute sulphuric acid (1 to 5 of water) acting on proteids produces a bluish-violet coloration when allowed to concentrate slowly. When the proteid matter is digested, the colour passes into the liquid; this shows a wide absorption band reaching from *C* to *E* or *b*.

The test may be employed microchemically. The colour disappears from sections when they are transferred from acid to water, alcohol, or saline solutions, and returns on placing them (even after 3 weeks) again in the acid, or in strong solutions of nitric or hydrochloric acids. Deposits of lardacein are shown very distinctly by this method.

W. D. H.

Separation of Albumoses from Peptone. By Paul Müller (*Zeit. physiol. Chem.*, 1898, **26**, 48—55).—The method suggested, which is stated to have advantages over Kühne's ammonium sulphate process, is a modification of that originally introduced by Schmidt-Mulheim.

To the solution, an equal volume of 30 per cent. ferric chloride solution is added, and then alkali until the reaction is only feebly acid. The voluminous precipitate is filtered off, and to the filtrate a pinch or two of zinc carbonate is added, the mixture shaken and again filtered. The final filtrate is free from albumoses.

If leucine and tyrosine are present, small quantities of these substances are carried down with the precipitate. W. D. H.

General and Physical Chemistry.

Dissociation-spectra of Fused Chlorides, Bromides, and Iodides. By Arnaud de Gramont (*Bull. Soc. Chim.*, 1897, [iii], **17**, 897—898, 899—900, 900—901).—The author has examined the spark-spectra of the chlorides of sodium, lithium, potassium, rubidium, cadmium, and zinc, the bromides of sodium, potassium, calcium, and zinc, and the iodides of sodium, potassium, and cadmium, and finds that they exhibit the chief lines of the spark-spectrum of the halogen present; detailed measurements are given in the paper, and the method can be used for the detection of minute traces of the halogens.

T. M. L.

Single Differences of Potential. By Hector R. Carveth (*J. Physical Chem.*, 1898, **2**, 289—321).—The author has determined a number of single differences of potential by the dropping mercury method, attention being directed more especially to the measurement of metals in solutions of their salts; in opposition to the results of Paschen, it would appear that both anion and cation have an effect. With different concentrations of the same electrolyte, the values obtained apparently follow in regular order. Cases in which the dropping electrode gives values corresponding with the polarisation method have been observed, as well as cases in which a difference in the values occurs. The solution pressure formula of Nernst was tested, and found to hold approximately in a few cases, whilst in the great majority of cases it failed. The author concludes that the values given by the drop electrodes are not true single differences of potential.

H. C.

Transference Number for Hydrogen. By Douglas McIntosh (*J. Physical Chem.*, 1898, **2**, 273—288).—The author, after attempting to determine the transference numbers for hydrogen in different acids by the Helmholtz method, using gas electrodes, comes to the conclusion that the method is not applicable to gas cells. It is probable that the source of error is to be found in the solubility of the electrode in the electrolytic solution. The results indicate that the transference number for hydrogen in hydrochloric acid does not change with the dilution between normal and thousandth-normal solutions.

H. C.

Influence of Pressure on the Electrical Conductivity of Solutions. By A. Bogojawlensky and Gustav Tammann (*Zeit. physikal. Chem.*, 1898, **27**, 457—473).—The influence of pressure is due to the changes produced in (1) volume, (2) viscosity, (3) degree of dissociation, (4) dissociation of the solvent, and is given by the equation $1/\lambda \times d\lambda/dp = 1/v \times dv/dp + 1/\eta \times d\eta/dp + 1/a \times da/dp + \lambda_1/\lambda a_1 \times da_1/dp$. The last term may be neglected if the number of ions of the solute far exceeds that of the solvent ions. The volume changes of aqueous solutions have been calculated in previous papers, and the first partial value is obtainable. From Cohen's determinations of the effect of pressure on viscosity, the values $1/\eta \times d\eta/dp$ are also obtainable for sodium chloride solutions. The effect of pressure on the dissociation constant is given by the expression $d \log. k/dp = -\Delta v/1000RT$, where Δv is the volume change (which must be expressed as a function of the pressure) consequent on the dissociation of a gram-molecule of the solute. The values $1/a \times da/dp$ are hence obtained, and from the sum of the three partial values the total pressure effects are calculated for pressures of 100, 200, 300, 400, and 500 atmospheres. The variation of the pressure effect with varying degrees of dissociation is seen in the case of the chlorinated acetic acids; the values for $1/\lambda \times d\lambda/dp$ decrease with increase of dissociation, and are in all cases in good accord with the values found. In the cases of aqueous solutions of ammonia and water, the volume changes consequent on dissociation are unusually great, hence also the conductivity change due to pressure; in the case of ammoniacal solutions the found and calculated values are compared, with fair agreement. For very dilute solutions, the dissociation of the solvent becomes important, and this is allowed for in the case of dilute solutions ($v = 500$ to $v = 50,000$) of hydrogen and sodium chlorides; the pressure effect is found to increase rapidly with dilution, but not as rapidly as calculated. The apparatus employed for the determination of conductivity at high pressures is described, and the results of the determinations are given, the compounds examined being solutions of acetic, monochloracetic, dichloracetic, trichloracetic, phosphoric, citric, tartaric, benzenesulphonic, and hydroferrocyanic acids, sodium phosphate, tartrate, and chloride, potassium citrate and ferrocyanide, and ammonia. L. M. J.

Thermal Equilibrium in Electrolysis. By DONATO TOMMASI (*J. Physical Chem.*, 1898, 2, 229—232).—A compound capable of being oxidised or reduced is submitted to the simultaneous action of an oxidising and a reducing agent. This is effected by making use of the mixture of hydrogen and oxygen obtained by the electrolysis of water containing in solution the compound under examination. The platinum electrodes are brought as closely together as possible, the liquid is frequently stirred, and the current reversed occasionally. The following results were obtained.

Initial compound.	Final compound.
Nitric acid.	Ammonia and nitrite.
Potassium nitrate.	,, ,,
Sodium nitrate.	,, ,,
Potassium nitrite.	Ammonia.
Potassium chlorate.	Perchlorate.
Arsenic acid.	No change.
Potassium arsenate.	,, ,,
Arsenious acid.	Arsenic acid.
Potassium arsenite.	Arsenate.
Ferrous sulphate.	Partial oxidation.
Ferric sulphate.	Partial reduction.

From these experiments, the author deduces the following laws.

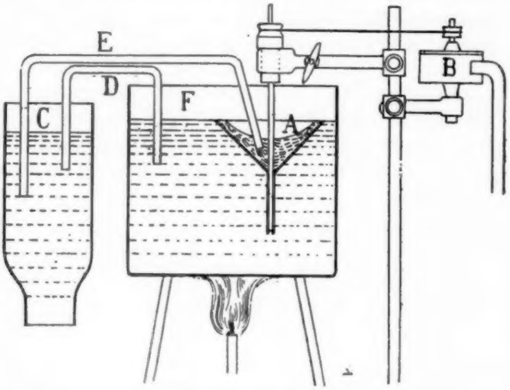
1. When a substance is submitted to two equal and contrary

chemical actions, the reaction which develops the most heat will take place in preference, provided always that it can begin.

2. Of two chemical actions, that which requires less heat to start it will always take place in preference, even if it develops less heat than the other action. H. C.

Magnetic Rotation in Salt Solutions. By S. Oppenheimer (*Zeit. physikal. Chem.*, 1898, 27, 447—456).—It has been shown by Perkin (Trans., 1889, 680; 1894, 20) and by Schönrock (Abstr., 1895, ii, 196) that the magnetic rotation of solutions of hydrogen chloride decreases with increase of concentration, and the author, therefore, endeavoured to determine whether the same effect could be observed with salt solutions if sufficiently sensitive instruments were used. The half-shadow apparatus used by Schönrock with a polarisation tube 80 cm. long was employed, and solutions of sodium and potassium chlorides and bromides, cadmium chloride, and acetic acid were examined, but in no case was any effect of concentration apparent. L. M. J.

Constant Temperature Device. By Hamilton P. Cady (*J. Physical Chem.*, 1898, 2, 242—244).—In order to keep a constant temperature in an apparatus which cannot be immersed in a bath, water having a constant temperature may be circulated round the apparatus by the device illustrated in the cut. A is an ordinary 75 mm. glass funnel mounted on a glass rod and running in the bearings of a Witt stirrer. F is a large water-bath kept at the desired temperature. C is the apparatus through which the water is to circulate. The siphon D connects C and F, so that the water comes to the same level in both vessels. A is adjusted so that the top of the funnel comes just at the surface of the water in F. The siphon E connects the interior of the funnel with C, so that when equilibrium is reached the level of the liquid in A, F, and C is the same. If A is caused to rotate, the water in A will be thrown out, and the level of the liquid will be lower than that in C. This will cause water to flow through E from C to A, and back again through D from F to C. This will set up a circulation of water through C which will continue as long as A is rotated. H. C.



Experimenting at Low Temperatures. By Walther Hempel (*Ber.*, 1898, 31, 2993—2997).—A test-tube 4 cm. wide was placed in a beaker 13 cm. wide, and the intermediate space packed with some non-conducting material. This apparatus was compared with a Dewar's tube, of which the inner vessel had the same dimensions as the test-tube; equal quantities of solid carbonic anhydride and ether were placed in each, and the temperature read at intervals by means of an electropyrometer. It was found that, with a packing either of eider-down or of pure wool dried at 100°, cooling was prevented almost as well as with the best-exhausted Dewar's tubes, and better than with the ordinary commercial ones. A packing of dry wool should, then, be placed round vessels in which ice or a freezing-mixture is kept, and filters in which it is desired to filter at a low temperature should be similarly packed; the filter may be a double one, with the space between filled with solid carbonic anhydride and ether.

For collecting solid carbonic anhydride, a cardboard funnel is recommended, with a very short neck closed with a cork, and an annular strip of linen fastened round the edge of the funnel so as to form a bag. The cylinder of liquid anhydride is placed mouth downwards in a slanting position; the linen bag is grasped with the gloved hand and gathered round the mouth of the cylinder, which is then opened; solid anhydride collects in the bag, and may be shaken down through the neck into a suitable receptacle. From 1 kilo. of the liquid anhydride, 270—300 grams of the solid can be obtained; at the prices current in Germany for the liquid, the solid thus costs 2*s.* per kilo. The lowest temperature (about −79°) is attained by mixing the solid anhydride with so much ether that not too stiff a magma is formed; the temperature then remains constant so long as solid particles are still present. C. F. B.

Boiling Point Curve for Benzene and Alcohol. By E. F. Thayer (*J. Physical Chem.*, 1898, **2**, 382—384).—The following table gives the percentage of benzene in the solutions examined, the boiling points, and the corresponding barometric readings in millimetres of mercury.

Benzene.	Temp.	Bar.
100·00	79·5°	736·9
95·18	70·8	728·5
93·87	69·6	728·5
92·64	68·8	728·5
85·28	67·6	736·3
76·00	67·1	736·0
67·15	66·9°	735·8
59·21	67·1	735·3
44·45	67·5	732·9
35·11	68·4	732·9
27·14	69·8	732·9
15·86	72·1	732·9

The first addition of alcohol to benzene lowers the boiling point a great deal; then comes a nearly horizontal curve followed by a rise at the alcohol end which is somewhat less steep than at the benzene end. H. C.

Boiling Point of Mixed Solutions. I. By Theodore W. Richards and Wentworth Lewis Harrington (*Zeit. physikal. Chem.*, 1898, **27**, 421—425).—By the addition of a gram-molecule of cadmium oxalate to 10 litres of water containing a slight excess of hydrogen chloride, the boiling point is depressed to the extent of 0·101°. This is explained by the formation of two almost undissociated molecules, namely, cadmium chloride and oxalic acid, thus $2H' + 2Cl' + CdC_2O =$

$CdCl_2 + H_2C_2O_4$. From the known dissociation of the hydrochloric acid, on the assumption that there is no dissociation in the products, the number of molecules removed is calculated as 1·6, hence the depression = 0·083°, whilst from the known effects of hydrochloric acid, cadmium chloride, and oxalic acid on the boiling point of water, the depression is calculated as 0·093°, both results being lower than that actually obtained. Analogous results were obtained by the use of cadmium citrate, the calculated depression being 0·364°, whilst the value found was 0·434°.

II. By **Clarence M. C. Gordon**, **L. J. Henderson**, and **W. L. Harrington** (*ibid.*, 425—428).—Experiments similar to the preceding were made with sodium chloride and cadmium sulphate; in this case, also, a depression of the boiling point occurs, owing to the dissociation of sodium sulphate being less than that of sodium chloride. The greatest possible decrease of molecular groups is given by $CdSO_4 + 2(1 - a)NaCl + 2aNa' + 2aCl' = CdCl_2 + Na_2SO_4$, that is, $= 2a$. From the known dissociation of sodium chloride, the maximum depressions (that is, for undissociated sodium sulphate) in the cases examined are 0·081° and 0·036°, whilst those found were 0·093° and 0·060°. From this, it appears that either the accepted dissociation values are incorrect, or that even in dilute solutions of cadmium salts double molecules occur.

L. M. J.

Study of a Three-Component System. By **Hector R. Carveth** (*J. Physical Chem.*, 1898, **2**, 209—228).—Numerous determinations were made of the freezing points of mixtures of the nitrates of lithium, sodium, and potassium, the results being plotted on the triangular diagram (Abstr., 1898, ii, 65). The composition and melting points of the three binary and the ternary eutectic mixtures are approximately as follows.

Percentage composition.			M. p.
$LiNO_3$	$NaNO_3$	KNO_3	
47	53	—	204°
34	—	66	129
—	45·5	54·5	218
30	14	56	120

H. C.

Thermochemistry of Sodium Suboxide and Peroxide. By **Robert de Forcrand** (*Compt. rend.*, 1898, **127**, 514—516).—The reaction Na_3O sol. + $2H_2O$ liq. + Aq = 3NaOH diss. + H gas develops + 97·78 Cal., hence Na_3 sol. + O gas = Na_3O sol. develops + 101·57 Cal. or + 67·62 Cal. for Na_2.

The reaction, Na_2O_2 sol. + 2HCl diss. = 2NaCl diss. + H_2O_2 diss. develops + 41·81 Cal., hence Na_2 sol. + O_2 gas = Na_2O_2 sol. develops + 119·79 Cal. The heat of formation of the monoxide is about 100 Cal.

The rapidity of the action of water and other reagents on the suboxide is partly attributable to the large area of its surface resulting from its porous character. C. H. B.

Heats of Formation of Cyanic Acid and Carbamide. By Marcellin P. E. Berthelot (*Ann. Chim. Phys.*, 1897, [vii], 11, 145—149).—This paper gives details of thermochemical determinations previously recorded (Abstr., 1897, ii, 7). G. T. M.

Thermochemistry of Formaldehyde. By Marcel Delépine (*Bull. Soc. Chim.*, 1897, [iii], 17, 849—859. Compare Abstr., 1897, ii, 359).—The author recognises two polymeric modifications of formaldehyde, namely, trioxymethylene or metaformaldehyde, $(CH_2O)_n$, produced by the polymerisation of anhydrous formaldehyde, and by the action of dehydrating agents on the concentrated aqueous solution; and paraformaldehyde produced on evaporating the aqueous solution. Paraformaldehyde is distinguished from metaformaldehyde by its solubility in water; it is invariably hydrated (compare Lösekann, Abstr., 1892, 423), and is regarded by the author as containing a number of compounds of the series $(CH_2O)_n,H_2O$, of which methylene glycol is the first member. It is now shown that the heat of formation of metaformaldehyde is identical with that of formaldehyde in aqueous solution, namely, 40·4 Cal.; as the heat of formation of the anhydrous substance is only 25·4 Cal. there is a development of heat = 15·0 Cal. in the polymerisation, which is, therefore, a strongly exothermic action. The dissolution of metaformaldehyde, which takes place when it is heated with water at 130° in sealed tubes, is an isothermic action, but two exothermic changes also occur,

$$\begin{array}{ll} 2CH_2O\text{ aq.} + H_2O\text{ liq.} = CH_3,OH\text{ aq.} + H{\cdot}COOH\text{ aq.} & +2\times 8{\cdot}1\text{ Cal.} \\ 3CH_2O\text{ aq.} + H_2O\text{ liq.} = 2CH_3,OH\text{ aq.} + CO_2\text{ gas} & +2\times 11{\cdot}0\quad ,, \end{array}$$

for this reason, formaldehyde is a methylating agent of greater power than methylic alcohol. The heat of formation of a specimen of paraformaldehyde, of the composition $CH_2O,\frac{1}{8}H_2O$ was found to be 42·5 Cal.; this value is 2 units greater than that of metaformaldehyde, and serves to explain the fact that the latter is only produced from the aqueous solution in presence of dehydrating agents.

The action of potash on aqueous formaldehyde does not lead to the production of any definite compound, although heat is developed, especially in concentrated solution. The development of heat depends only on the final, and not on the initial, concentration of the solution; thus, for molecular proportions,

$$\left\{\begin{array}{ll} CH_2O\text{ aq. (500 c.c.)} + KOH\text{ aq. (500 c.c.) gave} & +3{\cdot}10\text{ Cal.} \\ CH_2O\text{ aq. (100 c.c.)} + KOH\text{ aq. (900 c.c.)}\quad ,, & +3{\cdot}13\quad ,, \end{array}\right.$$

$$\left\{\begin{array}{ll} CH_2O\text{ aq. (1000 c.c.)} + KOH\text{ aq. (1000 c.c.)}\quad ,, & +2{\cdot}54\quad ,, \\ CH_2O\text{ aq. (100 c.c.)} + KOH\text{ aq. (1900 c.c.)}\quad ,, & +2{\cdot}61\quad ,, \end{array}\right.$$

The heat of dilution of the potash solution is insignificant, and that of the formaldehyde must, therefore, be equally small; as, however, a sudden development of heat occurs on diluting a concentrated solution, the slow absorption of heat which follows must be of equal magnitude; for the first phase, CH_2O aq. (100 c.c.) + H_2O (900 c.c.) gave + 0·45 Cal. The slow absorption of heat corresponds with the slow decrease of molecular weight observed by Grossman and Escheweiler (Abstr., 1890, 1092), and, in the opinion of the author, is due to the gradual dissociation of the paraformaldehyde in the solution. The first development of heat he regards as due to the hydration of monomolecular formaldehyde, and by cooling a 30 per cent. solution to $-40°$, he was able to separate a solid hydrate, which melted between $-30°$ and $-25°$, and had approximately the composition, $CH_2O + 3H_2O$. T. M. L.

Thermochemistry of Isoamylmalonic Acid. By GUSTAVE MASSOL (*Compt. rend.*, 1898, **127**, 526—528).—Isoamylmalonic acid, prepared by the action of isoamylic iodide on ethylic sodiomalonate and crystallised from ether, forms anhydrous crystals which melt at 98°; heat of dissolution, $-2·50$ Cal.; heat of neutralisation by potassium hydroxide, 1st equivalent $+13·90$ Cal.; 2nd equivalent $+13·95$; total $+27·85$ Cal. Heat of dissolution of the anhydrous potassium salt $+6·44$ Cal., hence $C_8H_{14}O_4$ sol. + 2KOH sol. = $C_8H_{12}O_4K$ sol. + $2H_2O$ sol. develops $+46·69$ Cal. The corresponding value for suberic acid is $+44·76$ Cal., hence the value of the acidic function is higher for isoamylmalonic acid than for suberic acid, a result which affords additional evidence in support of the conclusion previously arrived at that in the oxalic series the thermal value of the acidic function of the normal acid is lower than the corresponding value for its isomerides, and is always related to the degree of separation of the two carboxyl groups. C. H. B.

Solution of Solids and Liquids in Gases. By P. VILLARD (*Chem. News*, 1898, **78**, 297—298, 309—310. Compare Hannay and Hogarth, Abstr., 1880, 210; Pictet, 1895, ii, 201, and Villard, *ibid.*, 255).—At a temperature of 17°, gases under pressure take up considerable quantities of liquids and solids. Oxygen under 4 atmospheres absorbs an increased amount of bromine, which is still more marked at 50, 100, or 200 atmospheres. At 100 atmospheres, the density of the suspended bromine appears to be almost three times that of a saturated bromine atmosphere in a vacuum; the colour of the atmosphere under pressure is deeper than when no compression is employed, and when the pressure is released the bromine is deposited. Iodine also volatilises in compressed oxygen, but to a less extent than bromine, whilst air and hydrogen under pressure also sustain increased quantities of bromine.

Methane is very active in this direction; ethylic chloride at 180 atmospheres dissolves in 5 or 6 times its volume of methane, whilst at 200 atmospheres the two become miscible in any proportion and the surface of separation between the gas and the liquid disappears. The same phenomenon takes place with carbon bisulphide under about 550 atmospheres at the ordinary temperature, and under 250 atmospheres at 150°. Iodine, camphor, and paraffin also volatilise in compressed methane, and on releasing the pressure the iodine and camphor crystallise on the inside of the tube, and the paraffin falls out in brilliant flakes.

Ethylene under 300 atmospheres pressure takes up sufficient iodine to colour it a very deep violet, but in time the colour disappears as combination ensues. Compressed ethylene also dissolves paraffin, stearic acid, and camphor; the latter volatilises readily under small pressure, and when the pressure is increased to 150 atmospheres, the unvolatilised camphor becomes liquid, but continues volatilising as the pressure is further increased; on releasing the pressure, the same phenomena ensue, but in the reverse order. Compressed nitrous oxide takes up bromine to the same extent at 20 atmospheres as oxygen at 40 and compressed carbonic anhydride takes up iodine, but the pressures that can be obtained are limited by the liquefaction of the gas. Critical point phenomena are observed in these experiments either when the temperature is raised and the pressure kept constant or *vice versâ*. It is suggested that these observations may find application for the distillation of substances that are decomposed by heat; when taking up under pressure in a suitable gaseous medium and redepositing by relieving the pressure might in some cases prove more advantageous than distilling in a vacuum. D. A. L.

Solution Pressure of some Haloid Salts. By PAUL ROHLAND (*Zeit. anorg. Chem.*, 1898, **18**, 327—330.)—The solubility of the haloid salts of the alkali metals in alcohols decreases with rising molecular weight of the alcohol, and increases with rising molecular weight of the salt, the chlorides having the lowest and the iodides the greatest solubilities. In the case of the haloid salts of cadmium, copper, silver, mercury, and lead, the solubility also decreases with the rising molecular weight of the alcohol, but the iodides in these cases have the smallest and the chlorides the greatest solubilities.

H. C.

Some Reactions in Methylic Alcohol and Acetone. By PAUL ROHLAND (*Zeit. anorg. Chem.*, 1898, **18**, 322—326).—Methylic alcohol occupies a position, as a solvent, between that of water and ethylic alcohol. Ionisation takes place to a greater extent than in ethylic alcohol, and is in some cases even equal to that in water; reactions, therefore, usually take place in methylic alcohol as in water. In acetone, ionisation does not take place to the same extent, and the reactions are, therefore, frequently modified. Mercuric iodide is far more soluble in acetone than in water, and potassium chloride is much less soluble; consequently, in dilute solution in acetone, potassium iodide and mercuric chloride give a precipitate of potassium chloride. For similar reasons, potassium iodide and cadmium bromide give a precipitate of potassium bromide. H. C.

Benzene, Acetic Acid, and Water. By JOHN WADDELL (*J. Physical Chem.*, 1898, **2**, 233—241).—The distribution ratio of acetic acid in benzene and water as solvents was studied; an exponential formula of the general form $xy^n = \text{const.}$, where x and y refer to the amounts of benzene and water in a constânt quantity of acetic acid, is only found to give an approximate representation of the results. The ratio of acetic acid in water to acetic acid in benzene increases indefinitely with increasing dilution. The percentage of acetic acid in the aqueous phase passes through a maximum. The ratio of benzene to water in the more dense phase is greater than unity over a portion of the isothermal, even when the concentrations are expressed in reacting weights. H. C.

Equilibria of Stereoisomerides. By WILDER D. BANCROFT (*J. Physical Chem.*, 1898, **2**, 143—158, and 245—255).—The theory of permanent changes developed by Duhem (Abstr., 1897, ii, 439), and applied by him to explain the behaviour of supercooled sulphur, is extended by the author to organic compounds which exist in isomeric modifications, such as stilbene dichloride, acetaldoxime, benzaldoxime, and others. In general, we have in these cases two modifications in equilibrium in the liquid phase, the presence of the one lowering the freezing point of the other. If we take into account the element of time, equilibrium may be reached practically instantaneously, or in a measurable length of time, or the system will appear to contain two components provided we act rapidly enough, and one component provided we act slowly. If a solid substance melts at one temperature and freezes at another, this is proof positive of the existence of two liquid modifications, provided no decomposition takes place. If the more fusible of two solid modifications is the more stable, we are also justified in deducing the existence of two liquid modifications, although the converse is not necessarily true, and if the less fusible of two solid modifications is the more stable, it does not follow that only one liquid modification is possible.

A discussion is also given of the conditions under which a reversal of stability does and does not take place, on adding another component which forms no compounds with the two modifications. H. C.

Dissociation of Polyvalent Salts. By PAUL CALAME (*Zeit. physikal. Chem.*, 1898, **27**, 401—420).—The degrees of dissociation of a number of metallic salts of organic acids were determined at various dilutions, the ratio of the actual to the normal molecular depression being given. For formates and acetates, the values are almost identical; in the cases of zinc formate and acetate, and of lead acetate, the increase of dissociation with dilution is greater than for the other salts, so that the curves for these three compounds cut other curves. In the case of the acetates of calcium, strontium, and barium there is an apparent increase of dissociation with increase of concentration from N/4to N/2. For copper malate, the ratio is less than unity so that, probably, complex molecules are present. The concentrations of the copper ions in solutions of copper malate, citrate, glycerate, and salicylate were also calculated by the determination of the E.M.F. of copper chains containing these salts; the existence of complex molecules was indicated in the case of the three first salts, but not in the case of the salicylate, results in accord with the cryoscopic observations (Kahlenberg, Abstr., 1896, ii, 6). Magnesium fumarate was found to be more highly dissociated than magnesium maleate, a result which is in accord with Ostwald's law concerning the dissociation of dibasic acids (Abstr., 1892, 1145). L. M. J.

Molecular Weights of Liquids. By CLARENCE L. SPEYERS (*J. Physical Chem.*, 1898, **2**, 347—361 and 362—363).—The author applies the equation $n_1/(n_2+n_1)=(p-p')/p$, in which n_1 is the number of molecules of one constituent of a homogeneous mixture, n_2, the number of molecules of the other constituent, p, the vapour pressure in the pure state of that constituent to which n_2 refers, and p', the vapour pressure of the same constituent after the other constituent has been mixed with it, to the experimental results obtained by Linebarger and Raoult. He concludes that where discrepancies arise, these can be accounted for by association or dissociation of the constituents as given by the fundamental equation. He also shows that when two liquids are not miscible in all proportions, the separation of a second phase shows the sudden formation of more complex molecules on the part of one constituent. H. C.

Velocity of Hydrolysis of Maltose. By ALEXIUS VON SIGMOND (*Zeit. physikal. Chem.*, 1898, **27**, 385—400).—The velocity of hydrolysis of maltose was determined, hydrochloric acid being employed as the hydrolytic agent; the reaction was found to be of the first order, as in the case of sugar inversion, but the velocity increases slightly with the maltose concentration. The effect of rise of temperature was examined, and it was found that the exponential formula of Arrhenius (Abstr., 1889, 1103) applies here also, but the constant *A* of the formula being greater for maltose than for cane-sugar, the temperature effect is more marked in this case. The catalytic effects of hydrochloric, sulphuric, and oxalic acids were found to be in the ratio 100 : 40·5 : 14·1, whilst for cane-sugar the values are 100 : 53·7 : 18·2, so that, although the order is the same, yet the velocity is dependent, not only on the acid, but also on the sugar employed. The velocity-constants for the hydrolysis of cane-sugar and maltose by acetic acid were compared at 69·24°, the ratio being found to be 1133, but, owing to the different effects of temperature, this ratio would not remain constant for different temperatures. L. M. J.

Catalytic Action of Platinum Black. By ALEXANDER DE HEMPTINNE (*Zeit. physikal. Chem.*, 1898, **27**, 429—441).—Mond, Ramsay, and Shields (Abstr., 1898, ii, 599) have shown that the formation of a compound of platinum and hydrogen during the occlusion of the gas is very doubtful, and the author hoped to solve the question by the examination of the phenomena of occlusion at very low temperatures, since it seems probable that, if due to the formation of a compound, the occlusion would then be greatly diminished. The absorption of hydrogen by carbon, which appears to be purely mechanical, was found to be far greater at $-78°$ than at $+15°$, but in the case of platinum the reverse obtained, the absorption in all the experiments being greater at the higher temperature, whilst, if the absorption tube is allowed to slowly regain the higher temperature, a marked absorption of the gas occurs at about $-40°$. Freshly prepared platinum black possesses a very great absorptive power, even at the temperature of liquid air, so that at $-190°$ it induces the combination of oxygen and hydrogen. The absorption of carbonic oxide is completely analogous to that of hydrogen, and, according to Harbeck and Lunge, a definite compound of platinum and the gas exists (Abstr., 1898, ii, 166). For palladium and hydrogen, different results were obtained, the absorption being greater at the low temperature, although with carbonic oxide the results are similar to those obtained in the case of platinum. It was here noticed, also, that palladium which has been in equilibrium with carbonic oxide is in some respects altered, and has lost its power of absorbing hydrogen until a temperature of about $-20°$ is reached, when a sudden, great absorption occurs. The explanation of the phenomena must be deferred, but in the case of platinum and hydrogen, the formation of a compound appears to be indicated. L. M. J.

Catalytic Action in the Oxidation of Iodide by Bromic Acid. By NIKOLAI SCHILOFF (*Zeit. physikal. Chem.*, 1898, **27**, 513—518).—Catalytic actions in the above reaction were investigated for a large number of acids, salts, and organic compounds; acids usually cause acceleration, salts either acceleration or retardation, whilst neutral organic compounds have no effect. The greatest accelerative effects were those of potassium chromate and dichromate, ferrous and ferric salts, and pyrogallol, whilst sodium phosphite and sulphite, nitrobenzene, and resorcinol produced the greatest retardation. If the acceleration be measured by the expression $1/t_x - 1/t_o$, where t_x and t_o are the times required for the same amount of oxidation in the presence and absence respectively of the catalytic agent, it is found that in the case of potassium molybdate and chromate, the acceleration is a linear function of the concentration for very low concentrations only.

L. M. J.

Reaction between Potassium Persulphate and Potassium Iodide; Catalysis in the same Reaction. By THOMAS S. PRICE (*Zeit. physikal. Chem.*, 1898, **27**, 474—512).—The reaction may be represented thus: $S_2O_8'' + 2I' = 2SO_4'' + I_2$, and hence appears to be of the third order. The velocity constants as calculated for reactions of both second and third order were obtained; those for the second order are slightly more constant, but the results obtained thus are untrustworthy. The order may, however, be calculated by the expression $n = \log(dc_1/d\theta_1 \cdot dc_2/d\theta_2)/\log c_1/c_2$, where $dc/d\theta$ is the rate of change of concentration at the concentration c; the value $n = 2{\cdot}4$ is so obtained, again an uncertain result. If the time necessary for any given fractional change be found for any initial concentration A, then in a reaction of the first order $t =$ constant, for the second order $At =$ constant, &c. The values of t, At, and A^2t are, therefore, compared for a fractional change of one-fourth, and it is seen that the values At increase and those of A^2t decrease with dilution, so that definite results are not obtained. If the reaction is of the second order, however, equivalent changes in the concentration of both compounds should produce equal effects, and this being found to be the case, the author considers the reaction to be of the second order. This result may indicate the molecular formula KSO_4, which is not in accord with former work (Abstr., 1893, ii, 572), or that the order of the reaction depends, not on the number of molecules, but of compounds reacting. The author does not, however, discuss either these or any other possible explanations. Various salts were found to have a catalytic effect on the reaction, that of dissociated iron and copper salts being very marked. In the case of ferrous and copper sulphates, the acceleration (measured by the quantity $1/t_n - 1/t_o$) was found to be proportional to the concentration. Salts of nickel and cobalt cause a slight acceleration, but chromic acid, potassium dichromate, manganese sulphate, sodium nitrite, zinc sulphate, magnesium sulphate, and potassium sulphate were inactive. Mixtures of ferrous and copper sulphates were found to cause an acceleration almost double of that calculated additively, so that the catalytic effect of each is increased by the presence of the other. Inactive compounds, such as zinc sulphate, have no effect on the catalysis caused by copper sulphate, but decrease the influence of ferrous sulphate. The addition of acid, at first causes a decrease in the catalytic effect of copper sulphate, but a constant value is soon reached. L. M. J.

Atomic Weight of Tellurium in Relation to the Multiple Proportions of the Atomic Weights of other Simple Substances. By HENRY WILDE (*Compt. rend.*, 1898, **127**, 613—616).—This paper is largely controversial, and does not lend itself to abstraction. W. A. D.

Position of Tellurium and Iodine in the Periodic System. By HENRY WILDE (*Compt. rend.*, 1898, **127**, 616—618).—Metzner (Abstr., 1898, ii, 572) has recently obtained results which indicate that the atomic weight of tellurium (128) is greater than that of iodine; this, it is maintained, necessitates a change in position of these elements in the periodic system, and involves a contradiction of the accuracy of the latter. It is contended that if the order of the atomic weights of the elements is exactly followed, the law of periodicity of their properties ceases to be valid; also, that Mendeléeff's success in predicting the existence of gallium, scandium, and germanium was simply a consequence of Dumas' classification of the elements in families and to the relations shown to exist between the "equivalents" of the elements of a family. Boron, judging from its properties, should belong to the group containing phosphorus and vanadium (compare Étard, Abstr., 1881, 20), and should not be considered as the analogue of aluminium and gallium, as required by Mendeléeff's classification, whilst the position of gold, mercury, and lead is also looked on as abnormal. W. A. D.

Laboratory Sodium Burner. By CARL PULFRICH (*Chem. Centr.*, 1898, i, 763; from *Zeit. Instrumentk.*, **18**, No. 2).—In this apparatus, a round sheet of asbestos is held horizontally above a Bunsen burner by means of a clamp, which slides on a vertical rod attached to the burner. The sheet can be rotated so that the flame of the burner passes through one of several round holes, about 1 cm. wide, which are cut near the periphery of the sheet. By heaping the illuminating salt, preferably sodium nitrate, on account of its low melting point, or sodium bromide, which gives a more brilliant light, round the hole, a luminous flame may be maintained for a long time. The shape of the flame may be altered by changing the form of the hole. The apparatus, fitted also with a detachable carrier for platinum wires, is made by C. Desaga, in Heidelberg. E. W. W.

Inorganic Chemistry.

Presence of Free Hydrogen in the Atmosphere. By Armand Gautier (*Compt. rend.*, 1898, **127**, 693—694).—The air in the neighbourhood of towns contains variable quantities of combustible carbon compounds, only minute traces of which can be detected in the atmosphere of mountainous regions, and in sea air. On the other hand, pure air contains a small amount of free hydrogen, the proportion varying from 11 to 18 c.c. per 100 litres. G. T. M.

Decomposition of Hydrogen Peroxide by Silver Oxide. By Marcellin P. E. Berthelot (*Ann. Chim. Phys.*, 1897, [vii] **11**, 217—222).—An indefinite amount of hydrogen peroxide may be decomposed by a small quantity of silver oxide, the whole of the oxygen evolved being furnished by the peroxide, whilst the silver oxide is itself changed into the sesquioxide, Ag_4O_3, and free silver. If, however, the silver oxide is in excess, or if the solutions employed are not sufficiently dilute, or if excess of free alkali is present, then some oxygen is given up by the silver sesquioxide.

In employing this reaction for the estimation of hydrogen peroxide, it is preferable to employ dilute solutions, to prepare the silver oxide beforehand, and to avoid excess of this reagent; if the oxide be formed in the presence of the hydrogen peroxide by the action of caustic potash on silver nitrate, the heat evolved in this reaction promotes the decomposition of silver sesquioxide, which then gives off oxygen. G. T. M.

Decomposition of Hydrogen Peroxide by Ammoniacal Silver Oxide. By Marcellin P. E. Berthelot (*Ann. Chim. Phys.*, 1897, [vii], 11, 223—230. Compare preceding abstract).—When hydrogen peroxide is added to a suspension of ammoniacal silver oxide in water, a portion of the latter is reduced to metallic silver, and in so doing evolves oxygen; with excess of peroxide, the reduction is almost complete. When a solution of ammoniacal silver nitrate is added to hydrogen peroxide, the latter is decomposed, but only a slight reduction of silver oxide takes place; when the peroxide is added to the ammoniacal silver nitrate, four-fifths of the silver is precipitated in a crystalline form. When a solution of silver nitrate and hydrogen peroxide is added to ammonia, or *vice versâ*, more or less silver is always precipitated, the amount depending on the order of mixing and the strength of the solutions. No appreciable quantity of silver sesquioxide appears to be formed when ammoniacal solutions are employed (compare previous abstract). Ammoniacal silver nitrate (1 mol.) rapidly decomposes excess of hydrogen peroxide (30 mols.), but with a smaller proportion the reaction is slow and incomplete. Alkaline solutions of potassium silver cyanide and sodium silver thiosulphate have no action on hydrogen peroxide; ammoniacal silver

chloride causes a slow evolution of oxygen, which becomes more rapid when caustic potash is added, crystalline silver being deposited.
G. T. M.

Solubility of Iodine and Bromine in Water. By F. DIETZE (*Chem. Centr.*, 1898, i, 1094; from *Pharm. Zeit.*, **43**, 290).—According to the author, when iodine is shaken with water at 15°, 1 part dissolves in 3750 parts of water, whilst by heating water and iodine together and then cooling to 15°, 1 part of iodine is obtained in solution in 3500 parts of water. The solubility of iodine increases with the temperature, and at 30° 1 part dissolves in 2200 parts of water. The German pharmacopœia gives the solubility of iodine in water as 1 part in 5000, and that of bromine as 1 part in 30 parts of water. The latter, according to the author, is correct. E. W. W.

Preparation of Hydrogen Chloride, Bromide, and Iodide for Laboratory Purposes. By AD. VANDENBERGHE (*Chem. Centr.*, 1898, i, 916—917; from *Maandbl. naturw.*, **22**, 35—36).—When concentrated sulphuric acid is added drop by drop to strong hydrochloric acid, the liberated gas usually contains free chlorine and ferric chloride which are derived from impurities in the hydrochloric acid; according to the author, the gas may be purified by adding ferrous sulphate to the hydrochloric acid, whereby the chlorine is retained and the ferric chloride reduced to ferrous chloride. In order to test for free chlorine by means of starch paper, a solution of the gas must be used, as gaseous hydrogen chloride with starch paper always produces a blue coloration owing to oxidation of the acid.

Pure hydrogen bromide and hydrogen iodide may be obtained in a constant stream by allowing a solution of the acid, prepared by means of phosphorus, to drop on to phosphoric anhydride. In the case of hydrogen iodide, the first portions of the gas contain free iodine, which can be removed by passing it through a solution of calcium iodide. The gases are dried by means of phosphoric anhydride. When prepared from organic substances, the gases always contain volatile organic compounds. E. W. W.

Density and Molecular Weight of Ozone. By WILHELM STAEDEL (*Ber.*, 1898, **31**, 3143—3144).—The author points out that the assumption recently made by Ladenburg (this vol., ii, 18, 89) in his attempt to determine the density of ozone, that 1 molecule of iodine is liberated by 1 molecule of ozone is purely empirical, and in reality assumes the very quantity which is to be determined. The molecule of ozone may be expressed by the formula $O_2 + nO$, so that each molecule of ozone liberates n molecules of iodine. Without independent information as to the value of n, it is impossible to deduce the density of ozone from the density of a mixture of this gas with oxygen, and an estimation of the amount of iodine liberated per unit volume of this mixture. A. H.

Density and Molecular Weight of Ozone. By MAX GRÖGER (*Ber.*, 1899, **31**, 3174—3176).—In a recent paper by Ladenburg (this vol., ii, 18, 89) the density of a specimen of ozonised oxygen is given, and also the weight of iodine liberated by the gas when in contact with potassium iodide, and by means of these numbers, taken in conjunction with the fact that the gas undergoes no alteration in volume during the action referred to, an attempt is made to prove that the molecule of ozone is triatomic. The argument employed is fallacious, as the excess of the density of the ozonised gas over that of pure oxygen represents the weight of oxygen available for the liberation of the iodine, and the amount of the latter set free may be at once calculated if that excess be known, whatever be the molecular weight of the ozone concerned. A. L.

Hydrates of Gases. By P. VILLARD (*Ann. Chim. Phys.*, 1897, [vii], **11**, 289—394).—The author gives full details of the apparatus employed by him in obtaining the hydrates of the following gases, nitrous oxide, carbonic anhydride, acetylene, ethylene, methylic chloride, and sulphurous anhydride, and in investigating their physical properties (compare Abstr., 1888, 1020, 1241; 1890, 1386; 1895, i, 635; ii, 44, 497).

The preparation of the hydrates of the following liquids, methylic iodide, ethylic chloride, bromide and iodide, methylenic chloride, chloroform, carbon tetrachloride, ethylidenic chloride, chlorethylene ethylenic chloride, and carbon bisulphide is described, and their properties are compared with those of the hydrates of the gases.

The influence of inert gases under pressure on the dissociation of these hydrates is fully discussed. G. T. M.

Action of Sodammonium on Arsenic. By C. HUGOT (*Compt. rend.*, 1898, **127**, 553—555).—Whereas different products are obtained by the action of sodammonium on phosphorus in presence of liquefied ammonia, according as the phosphorus is present in small quantity only or in excess (Abstr., 1896, ii, 20, and 1898, ii, 573), arsenic gives rise to only one *derivative*, $AsNa_3,NH_3$, under all conditions. In the experiments described, both the arsenic and sodium were carefully purified by distillation, and were allowed to interact under the same conditions as were employed formerly in the case of phosphorus (*loc. cit.*). A brick-red product was obtained, which contained traces of sodamide, and dissolved only sparingly in liquid ammonia; from the latter solution, small crystals of the compound were obtained. W. A. D.

Compounds of Carbonic Anhydride with Water, Ethylic Ether, and Alcohols. By WALTHER HEMPEL and JOHANNES SEIDEL (*Ber.*, 1898, **31**, 2997—3001).—A weighed quantity of water was sealed in a tube with solid carbonic anhydride; at the ordinary temperature, the liquid formed two layers, the water underneath; on cooling the tube slowly, crystals formed; these began to melt at about 8°. The tube was then cooled to –79°, opened, furnished with a delivery tube dipping under mercury, and then allowed to rise in temperature; carbonic anhydride was evolved furiously at first, but ceased to come off at – 25°; at – 2°, the evolution of gas again commenced, and the volume that came off between this temperature and + 20° corresponded with a composition of $CO_2 + 8H_2O$ for the crystals; another experiment gave results corresponding with $CO_2 + 9H_2O$.

Aqueous ether was saturated with solid carbonic anhydride, and the solid that formed was collected on a cooled filter; the loss of weight which it underwent up to 0° was taken as carbonic anhydride, and that at 0—37° as ether, the rest being water; the error of such an estimation is 2—3 per cent. It was found that the composition of the solid varied with the temperature at which it had been collected. At a very low temperature, little else but carbonic anhydride was present; the amount of ether, and still more that of the water, increased with the temperature of isolation; at $-50°$ the composition corresponded approximately to $CO_2 + 4H_2O + Et_2O$.

With aqueous ethylic alcohol, a compound $17CO_2 + 3EtOH + H_2O$ was obtained. Monocarbonates of alkyl radicles, $ROH + CO_2$, were obtained by weighing a quantity of the alcohol into a tube, distilling into it excess of liquid carbonic anhydride, and then allowing the excess to evaporate and cooling the tube. The *methyl, ethyl, tertiary butyl,* and *amyl* compounds melt at -57 to $-60°$, -61 to $-57°$, -15 to $-10°$, and $-60°$; the mixture with *propylic* alcohol separates, on cooling, into two layers which melt at $-56°$ and $-50°$ respectively. C. F. B.

Examination of Sodium Phosphate for Sodium Carbonate, and Reaction of Sodium Phosphate with Phenolphthalein. By BRUNNER [Wetzlar] (*Zeit. anal. Chem.*, 1898, **37**, 740—741).—The author cannot confirm Geissler's statement (Abstr., 1898, 458) that pure disodium hydrogen phosphate does not give a pink colour with phenolphthalein. The purest salt obtainable, recrystallised from a solution, which, after being strongly acidified with phosphoric acid, has been boiled for a long time to ensure the complete decomposition of carbonate, exhibits an alkaline reaction with both litmus and phenolphthalein even when its immediate mother liquor is feebly acid. M. J. S.

Preparation of Lithium and Calcium Ammonias and Corresponding Amides. By HENRI MOISSAN (*Compt. rend.*, 1898, **127**, 685—693).—Dry ammonia gas combines with potassium, sodium, lithium, and calcium, and the superior limit of temperature at which this reaction occurs is $-20°$ for sodium, $-2°$ for potassium, 20° for calcium, and 70° for lithium; solid ammonia at $-80°$ is without action on these metals. The sodium and potassium ammonias decompose at $-20°$ and $-2°$ respectively, whereas the calcium and lithium compounds are stable at ordinary temperatures.

Lithium ammonia, Li,NH_3, is obtained as a brownish-red solid when the liquid produced by the action of dry ammonia gas on lithium at ordinary temperatures is rapidly heated to 70°; if produced at lower temperatures, it always contains more ammonia than that demanded by the above formula. When allowed to remain for any length of time at the ordinary temperature, a solution of lithium ammonia in liquid ammonia yields lustrous, transparent crystals of lithamide. This reaction proceeds more rapidly at 65—80°, and appears to be independent of the pressure. If solid lithium ammonia heated at 50° or 60° is exposed to the rapid action of the vacuum pump, ammonia is evolved and crystalline lithium is obtained; if the exhaustion is effected more slowly at ordinary temperatures hydrogen is also evolved, and the residue consists of lithium and lithamide.

Calcium ammonia, $Ca,4NH_3$, is obtained as a brownish-yellow solid with a bronzy reflex when crystallised calcium is treated with dry ammonia at 15°—20°; it evolves ammonia and hydrogen at ordinary temperatures, and is slowly converted into *calcamide*, $Ca(NH_2)_2$.

Both the lithium and calcium compounds take fire when exposed to air, and are far less soluble in liquid ammonia than the corresponding sodium compound. These substances are being investigated both by the author and by Güntz, the latter having independently examined the action of ammonia on calcium obtained from lime by reduction with magnesium.

G. T. M.

Properties of Calcium. By HENRI MOISSAN (*Compt. rend.*, 1898, **127**, 584—590).—Pure calcium, prepared by the author's method (Abstr., 1898, ii, 578), separates from fused sodium in hexagonal crystals, which have a sp. gr. = 1·85, and melt, in a vacuum, at 760°; after solidifying, the metal is less malleable than sodium or potassium, and is somewhat brittle, showing a crystalline fracture. When free from nitride, its surface is brilliant, and silver white in colour. When exposed at a dull, red heat to a stream of hydrogen, the crystalline hydride, CaH_2, is formed. Contrary to Matthiessen's statement (*Annalen*, 1855, **93**, 277), calcium is not acted on by chlorine at the ordinary temperature, but at 400° vigorous action occurs, calcium chloride being formed; chlorine, however, readily combines at the ordinary temperature with calcium containing nitride, a fact which explains Matthiessen's result. The metal is not acted on by bromine or iodine at the ordinary temperature, but burns vigorously when heated in the vapours of these elements. It ignites in oxygen at 300°, and burns brilliantly, the oxide formed being partially fused and volatilised. When calcium is gently warmed in air, it burns with brilliant scintillations; at a dull red heat, a partially fused mass is obtained, which is decomposed by water, giving ammonia and calcium hydroxide; no peroxide appears to be formed. At 400°, calcium and sulphur combine with incandescence, the sulphide obtained being a white powder, which dissolves in dilute hydrochloric acid without depositing sulphur. With selenium and tellurium, calcium also combines, whilst it burns with incandescence in the vapour of phosphorus, giving a product which decomposes water to form spontaneously inflammable hydrogen phosphide. Arsenic, at the temperature at which it sublimes, gives, with calcium, a dark-coloured, fused mass, which decomposes water, forming hydrogen arsenide and a black, insoluble powder; *calcium antimonide*, however, prepared similarly, does not yield hydrogen antimonide when decomposed by water or dilute hydrochloric acid, but only a black, insoluble powder, and the same is true of the *compounds* of calcium and bismuth, although here hydrogen is also evolved. At a red heat, calcium combines vigorously with lamp-black, yielding only one carbide, CaC_2, whatever proportions are employed; *calcium silicide*, prepared by strongly heating a mixture of its constituent elements, is not decomposed by water, but dissolves in hydrochloric acid, slowly at the ordinary temperature, rapidly when heated, giving hydrogen, silicon hydride, and a large quantity of silicon.

Calcium does not readily dissolve in potassium, but yields somewhat brittle *alloys* with magnesium, zinc, and nickel; with tin, a crystalline *alloy* is obtained, which contains 3·82 per cent. of calcium, has a sp. gr. = 6·70, and decomposes water very slowly. With mercury, calcium combines at the ordinary temperature to form a crystalline *amalgam*, heat being evolved; although no calcium hydride is formed when this is distilled in an atmosphere of hydrogen at 400°, the amalgam is rapidly decomposed by nitrogen, under similar conditions, giving calcium nitride, and blackens when exposed to air at the ordinary temperature, owing to the fixation of both oxygen and nitrogen.

At a red heat, calcium liberates the alkali metal from potassium or sodium chloride; the corresponding iodides are, however, not affected. When calcium is fused with calcium iodide, a *subiodide* appears to be formed, which is also obtained in the form of red, transparent crystals, when calcium iodide is decomposed electrolytically; calcium chloride, under the like conditions, behaves in a similar manner.

Calcium is only slowly acted on by pure water at the ordinary temperature, hydrogen being evolved; when heated in sulphurous anhydride, it becomes incandescent, a complex change taking place. In nitric oxide, it burns brilliantly, giving rise to calcium oxide only, no nitride being formed. At a red heat, calcium combines with phosphoric anhydride with explosive violence; at 600°, it reduces boric anhydride to boron, without the production of calcium boride (Moissan and Williams, Abstr., 1898, ii, 116), and at a red heat decomposes silica, giving calcium silicide and a small quantity of silicon. When slowly heated in carbonic anhydride, it is only partially acted on, carbon, calcium oxide, and a small quantity of calcium carbide being formed; when, however, the heating is rapid, the whole of the metal is converted into oxide and carbide. With carbonic oxide, the action is always incomplete, some carbon being liberated. Uranium sesquioxide, and titanic and vanadic acids are reduced, when heated with calcium, to lower oxides.

Fuming nitric acid acts only very slowly on pure calcium; when very slightly diluted, however, the action is rapid. Cold fuming sulphuric acid is immediately reduced by the metal, sulphur and sulphurous anhydride being formed, whilst sulphuric monhydrate gives rise, in addition, to hydrogen sulphide. Both hydrochloric and acetic acids dissolve calcium with evolution of hydrogen. When heated in gaseous hydrogen chloride, the metal becomes incandescent and is converted into chloride; hydrogen sulphide, under similar conditions, produces calcium sulphide.

Calcium is not acted on by ammonia gas in the cold, but at a dull, red heat it is converted into a mixture of hydride and nitride; with liquefied ammonia at −40°, calcium gives rise to *calcium ammonia*, a reddish-brown solid, the study of which is being continued. Calcium decomposes boron bromide at a dull red heat, giving calcium boride and boron; the latter is also obtained on heating a mixture of calcium and boron nitride, calcium nitride being formed. At a dull red heat, calcium is only partially acted on by acetylene, ethylene, and methane, a crust of carbon, carbide, and nitride being formed, which prevents further action. W. A. D.

Calcium Amalgam. By JULES FERÉE (*Compt. rend.*, 1898, **127**, 618—620).—When a well cooled 50 per cent. aqueous solution of calcium chloride is decomposed electrolytically, using a mercury electrode and a porous diaphragm, so arranged that the chlorine generated cannot act on the calcium amalgam formed, the latter is found to be much richer in calcium than the amalgam obtained by Maquenne (*Bull. Soc. Chim.*, 1892, 366); when submitted to distillation in a vacuum, 1·2 per cent. of a *compound*, Ca_3Hg_4, is left. The amalgam is a porous, whitish-green substance, which rapidly oxidises in air, and readily decomposes water. When heated in an atmosphere of hydrogen, it loses mercury, but does not form calcium hydride. Its remaining properties are identical with those given by Moissan (preceding abstract). In conclusion, the author confirms the formula Ca_3N_2 for calcium nitride, by analyses based on its conversion by dilute sulphuric acid into calcium and ammonium sulphates.

W. A. D.

Preparation and Properties of Calcium Nitride. By HENRI MOISSAN (*Compt. rend.*, 1898, **127**, 497—501).—Calcium at a dull red heat combines with nitrogen with incandescence to form a nitride, Ca_3N_2. The calcium is best placed in nickel dishes in a nickel tube. The nitride forms transparent, brownish-yellow, microscopic crystals, which are deeper in colour if they contain unaltered calcium; sp. gr. = 2·63 at 17°. It is attacked by hydrogen below dull redness, with formation of the hydride and ammonia; by chlorine and bromine, with incandescence in the cold, or on very gently heating, and by iodine at dull redness; by oxygen, below a red heat, with incandescence; by sulphur, at about 500°, and by phosphorus vapour at a cherry-red heat, but not by boron or silicon at 1000°. Carbon has no action on the nitride at 800°, but completely decomposes it in a few minutes in the electric furnace; at 1200°, small quantities of cyanide are formed.

Sodium, potassium, and magnesium have no action on the nitride at a red heat; nitric oxide attacks it slowly below dull redness and violently, with incandescence, at a higher temperature. Dilute acids dissolve the nitride, but no action takes place in complete absence of water. Alcohol gradually decomposes it at the ordinary temperature, with production of ammonia and calcium ethoxide; ethylic chloride attacks it at a dull red heat, with production of methane, ammonium chloride, and calcium chloride.

When calcium can be prepared on a large scale, it can readily be made to combine with nitrogen separated from the air, and the nitrogen can be converted into ammonia by the action of steam on the nitride. C. H. B.

Action of Water on Calcium Carbide. By ERNEST CHUARD (*Bull. Soc. Chim.*, 1897, [iii], **17**, 678—679).—The gas evolved when water acts on calcium carbide contains 0·03—0·06 per cent. of ammonia, produced by the action of water on the calcium nitride, which is always present. Ammonia is also found in the residues, and is derived from the action of water on calcium cyanate.

The presence of hydrogen sulphide and phosphine in the acetylene has also been proved. The latter impurity forms 0·018—0·032 per cent. of the gas, and its presence accounts for the insecticidal properties of acetylene prepared in this manner. By introducing calcium phosphate into the material used in preparing the calcium carbide, the relative amount of phosphine in the gas, and therefore the insecticidal power, is greatly augmented, and it is hoped that it may find an application in the treatment of phylloxera-infested vines.

A. L.

Simple and Complex Magnesium Pyrophosphates. By Marcellin P. Berthelot and Gustave André (*Ann. Chim. Phys.*, 1897, [vii], **11**, 190—197).—The precipitate obtained, either from sodium pyrophosphate in the estimation of pyrophosphoric acid (Abstr., 1897, ii, 140), or from sodium metaphosphate under similar conditions, consists of the double salt $Mg_3(NH_4)_2(P_2O_7)_2 + nH_2O$ mixed with $Mg_3Na_2(P_2O_7)_2$ in the proportion of three of the former to one of the latter; it also contains a small quantity of an alkali acetate. The double salt retains the whole of its ammonia, even when heated to 110°, or when repeatedly washed with dilute acetic acid; the latter treatment removes some of the magnesium, but the quantity of phosphoric acid thereby rendered soluble is inconsiderable, and only amounts to 0·1 per cent.

Excess of ammonium salts is necessary to ensure the complete precipitation of pyrophosphoric acid. A boiling solution of sodium pyrophosphate, treated with a mixture of magnesium chloride and acetic acid, yields a precipitate of the simple pyrophosphate, $Mg_2P_2O_7$; but the filtrate still contains nearly one-third of the total phosphorus.

G. T. M.

Artificial Boracites containing Iodine. By H. Allaire (*Compt. rend.*, 1898, **127**, 555—557).—The author describes several substances containing iodine, which are analogous with natural boracite in composition and crystalline habit. The *magnesium-boracite*, $6MgO,8B_2O_3,MgI_2$, is obtained only with difficulty by passing the vapour of magnesium iodide over heated magnesium borate; it is also formed, but in an impure state, by the action of iodine on a mixture of magnesium and its borate heated in an atmosphere of hydrogen; it forms colourless cubes and tetrahedra. The *zinc boracite*, $6ZnO,8B_2O_3,ZnI_2$, is, however, readily prepared by passing a stream of carbonic anhydride laden with iodine vapour over a heated mixture of zinc and zinc borate; the *cadmium* compound, $6CdO,8B_2O_3,CdI_2$, and the *manganese* and *iron* compounds of corresponding composition, are prepared similarly, and closely resemble the zinc derivative, but the *nickel* compound, $6NiO,8B_2O_3,NiI_2$, is yellow, and the *cobalt* compound, $6CoO,8B_2O_3,CoI_2$, violet in colour.

A better method of preparing boracites containing chlorine than has been hitherto given (compare Rousseau and Allaire, Abstr., 1893, ii, 468, and 1894, ii, 413) consists in passing hydrogen chloride over the corresponding amorphous borate at a dull red heat; the product is well crystallised and pure. Several of the artificial boracites which contain iodine can be prepared by fusing molecular proportions of the iodides of sodium and of the metal chosen with boric acid and a small quantity of borax, in a steel crucible on to which is fitted a cover furnished with a small iron exit-tube; this is necessary in order to prevent aqueous vapour from the furnace coming into contact with the contents of the crucible. W. A. D.

Crystallised Basic Cupric Chlorate. By LÉON BOURGEOIS (*Bull. Soc. franç. Min.*, 1898, **21**, 170—176).—Crystals of cupric chlorate, $Cu(ClO_3)_2 + 6H_2O$, fuse at 65° in their water of crystallisation to a blue, syrupy liquid; decomposition commences at 100°, and takes place rapidly at 110—140° with evolution of gas and formation of the basic salt $Cu(ClO_3)_2,Cu(OH)_2$. Bluish-green crystals, 1—2 mm. across, of this basic salt are obtained when the heating is effected in a flask on a sand-bath. Smaller crystals are obtained by heating a solution of cupric chlorate with fragments of marble or with carbamide in a sealed tube at 130°. The crystals have a sp. gr. = 3·55; they are monosymmetric, and are isomorphous with the corresponding nitrate, $Cu(NO_3)_2,Cu(OH)_2$. When cupric nitrate is heated in the same manner, orthorhombic crystals of the mineral gerhardtite, a dimorphous form of $Cu(NO_3)_2,Cu(OH)_2$, are formed. Cupric bromate yields a greenish-blue, crystalline powder of basic bromate. L. J. S.

New Hydrate of the Saline Oxide of Chromium [Cr_3O_4]. By GEORGES BAUGÉ (*Compt. rend.*, 1898, **127**, 551—553).—When chromous sodium carbonate (Abstr., 1898, ii, 294), or, better, the corresponding potassium compound (*ibid.*, 598), is boiled with water in an atmosphere of carbonic anhydride, a somewhat unstable, brick-red *powder* is precipitated, having apparently the composition $Cr_3O_4 + 4H_2O$; when dried in a vacuum at 100°, it gives rise to a yellowish-brown *compound*, $Cr_3O_4 + 3H_2O$, which has a sp. gr. = 3·49, and is converted into chromium sesquioxide by the action at 250° of water-vapour, hydrogen chloride, or an inert gas, hydrogen being evolved; it is also decomposed by chlorine at a dull red heat, giving chromyl chloride, water, and hydrogen chloride. Although stable in dry air at the ordinary temperature, it is rapidly oxidised to chromium sesquioxide in presence of water or when heated; by hydrogen sulphide, it is converted at a somehat elevated temperature into a crystalline sulphide, whilst it rapidly reduces dilute sulphuric acid at 40°, hydrogen sulphide being evolved if a large quantity of the oxide is employed. When the latter is dissolved in concentrated hydrochloric acid, a mixture of chromous and chromic chlorides is obtained. All attempts to convert the oxide $Cr_3O_4 + 3H_2O$ into the compound $Cr_3O_4 + H_2O$ described by Peligot (*Ann. Chim. phys.*, [iii], 1844, **12**, 539) failed.
W. A. D.

Iron Chromium Carbide and Iron Molybdenum Carbide. By PERCY WILLIAMS (*Compt. rend.*, 1898, **127**, 483—484).—*Iron chromium carbide*, $3Fe_3C,2Cr_3C_2$, intermediate between the carbides $3Fe_3C,Cr_3C_2$ and $Fe_3C,3Cr_3C_2$ described by Carnot and Goutal, is obtained by heating a mixture of chromic oxide, 200 grams; iron, 200 grams; and petroleum coke, 70 grams, in a carbon crucible for 5 minutes with an arc from a current of 45 volts and 900 ampères. The crystalline ingot thus obtained, which resembles ferrochrome in appearance, is treated with aqua regia at 100°, and any graphite that remains is removed by levigation with bromoform. The carbide forms very brittle needles with a metallic lustre and the colour of nickel; sp. gr. = 7·22 at 19°; hardness between glass and rock crystal. It is attacked by chlorine at a red heat, and also, although more slowly, by bromine and iodine; by oxygen and water vapour at about 500°, and by gaseous or dissolved hydracids, but not by nitric acid or aqua regia.

Iron molybdenum carbide, Fe_3C,Mo_2C, is prepared in an exactly similar way from a mixture of molybdenum dioxide (prepared by heating ammonium molybdate), 130 grams; iron, 300 grams; and petroleum coke, 50 grams. The ingot is treated with hydrochloric acid instead of aqua regia, and the insoluble residue is separated into two parts by means of a magnet. The non-magnetic part consists of graphite, which is separated by means of bromoform or methylenic iodide, and the iron molybdenum carbide, which consists of a grey powder of microscopic, arborescent crystals resembling those of antimony; sp. gr. = 7·47 at 18°. The carbide is attacked by chlorine, bromine, iodine, or the gaseous or dissolved hydracids when heated, but is most readily dissolved by dilute nitric acid.

In the preparation of these and similar carbides there is always a relation between the proportions of carbide and of graphite respectively in the ingot obtained; the one seems to vary inversely as the other, and the manner of cooling exercises a considerable influence on the proportions. C. H. B.

Preparation of Tungsten, Molybdenum, Chromium, and Manganese Silicides. By Henry N. Warren (*Chem. News*, 1898, **78**, 318—319).—When aluminium is added to a well fused mixture of 2 parts of cryolite with 1 part of sodium silicate, reaction proceeds tranquilly, which is not the case when potassium silicofluoride is employed. A mass of graphitoidal silicon mixed with aluminium is obtained, from which the latter is removed by means of hydrochloric acid.

Manganese silicide is obtained when any oxide of manganese is reduced at a full white heat in presence of excess of silicon; it contains 30 to 40 per cent. of silicon, has a white, metallic lustre, is fusible, brittle, and hard enough to scratch glass.

Chromium silicide resembles the manganese compound, but is less fusible, harder, and offers greater resistance to reagents.

Tungsten and *molybdenum silicides* require the full heat of an oxyhydrogen furnace for their preparation, and when the reaction is properly conducted, they form well fused masses; they are crystalline and very hard, in some cases scratching quartz, tungsten silicide being the harder. All these silicides are decomposed readily by hydrofluoric acid and by chlorine at a red heat; other acids, however, only act on them with difficulty. D. A. L.

Electrolytic Production of Crystalline Tungsten. By L. A. Hallopeau (*Compt. rend.*, 1898, **127**, 755—756. Compare Moissan, Abstr., 1896, ii, 606, and this vol., ii, 32).—Lithium paratungstate heated to 1000° is submitted for 3 hours to the action of an electric current of 3 ampères with an E.M.F. of 15 volts. The product, after extraction with hot water, concentrated hydrochloric acid, and lithium hydroxide solution, consists of crystalline tungsten, which is contaminated with more or less platinum derived from the electrodes. The tungsten thus obtained forms opaque prismatic crystals with a metallic lustre, and having an acicular habit like those of silicon.

G. T. M.

Tungsten Tetriodide. By ED. DEFACQZ (*Compt. rend.*, 1897, **127**, 510—512).—*Tungsten tetriodide*, WI_4, obtained by the action of an excess of liquid hydrogen iodide on tungsten hexachloride at 110°, is a black, crystalline substance of sp. gr. 5·2 at 18°, insoluble in water, ether, chloroform, and turpentine, but soluble in absolute alcohol; it does not melt, and does not sublime without decomposing. Hydrogen reduces it below a red heat, chlorine displaces the iodine at the ordinary temperature, and bromine displaces it at 100°. Water decomposes it slowly in the cold, and rapidly on boiling, and it is readily attacked by dilute hydrochloric and sulphuric acids, and by nitric acid and aqua regia, which convert it into tungstic acid. Alkali hydroxides and carbonates, whether in solution or fused, and fused potassium hydrogen sulphate also readily decompose the tetriodide (compare Abstr., 1898, ii, 521). C. H. B.

Crystallised Tungsten Dioxide and a Tungstolithium Tungstate. By L. A. HALLOPEAU (*Compt. rend.*, 1898, **127**, 512—514).—When lithium paratungstate is heated in a current of hydrogen at about the melting point of glass for 45 minutes, it is completely reduced to tungsten dioxide, which is obtained as an opaque, brown, microcrystalline powder with a coppery lustre, by treating the product of reduction successively with boiling water, concentrated hydrochloric acid, and lithium hydroxide solution (20 : 100), and finally washing thoroughly with warm water. The dioxide thus prepared is of constant composition; it is not attacked by hydrochloric and sulphuric acids, or by concentrated solutions of the alkalis either at the ordinary temperature or on heating. Nitric acid oxidises it to tungstic acid, and when heated in oxygen it burns and yields pure microcrystalline tungstic anhydride.

If the paratungstate is fused with a fragment of tin for about an hour, and the product is treated in the same way as the product of reduction in hydrogen, it yields a very deep blue powder consisting of microscopic prisms of the "tungsten bronze," $Li_2W_5O_{15}$ or $Li_2O,WO_3 + WO_2,3WO_3$, analogous to the sodium compound prepared in the same way. C. H. B.

Action of Metallic Sulphates on Potassium Paratungstate. By L. A. HALLOPEAU (*Compt. rend.*, 1898, **127**, 620—621. Compare von Knorre, Abstr., 1885, 1184, and 1886, 597).—On mixing solutions of potassium paratungstate and magnesium sulphate in molecular proportion, and concentrating the product, the *double salt*,

$$12WO_2,5(\tfrac{2}{3}K_2O + \tfrac{1}{3}MgO) + 24H_2O,$$

separates in hexagonal prisms; it is almost insoluble in cold water, but dissolves more readily in hot, and loses $17H_2O$ at 100°. When solutions of potassium paratungstate and manganese sulphate are mixed, the *salt*, $12WO_3,3K_2O,2MnO + 16H_2O$, is immediately precipitated as a colourless, crystalline powder, which loses $10H_2O$ when dried at 100°. The *zinc* double salt is crystalline, but cannot be obtained pure, whilst the *cadmium* and most other double salts are amorphous. W. A. D.

Crystallised Uranium Phosphate. By LÉON BOURGEOIS (*Bull. Soc. Philomatique, Paris*, 1897, **9**, 125—130; and *Bull. Soc. franç. Min.*, 1898, **21**, 32—39).—From a solution of precipitated uranium phosphate in hot water acidified with hydrochloric acid, yellow crystals, 2—3 mm. across, of $H(UO_2)PO_4 + 4H_2O$ are deposited after some time. These have the sp. gr. 3·03, and are square, tetragonal plates with angles closely related to those of the minerals cupro-uranite, $Cu(UO_2)_2(PO_4)_2 + 8H_2O$, and calco-uranite, $Ca(UO_2)_2(PO_4)_2 + 8H_2O$, &c. Crystallised cupro-uranite has often been prepared by the action of copper phosphate on uranium nitrate, but attempts to obtain calco-uranite always result in the formation of $H(UO_2)PO_4 + 4H_2O$. L. J. S.

Pure Platinum Metals of Commerce. By FRANZ MYLIUS and RUDOLF DIETZ (*Ber.*, 1899, **31**, 3187—3193).—A number of ingots of purified platinum metal supplied by the firm of Hereaus of Hanau were analysed with the object of ascertaining the degree of purity attained in the commercial processes of purification. Platinum was not perceptibly impure. Palladium contained at least 99·9 per cent. of pure metal, 0·05 per cent. of platinum being also present. Iridium contained not more than 0·3 per cent. of impurities, of which a trace was ruthenium and 0·15 per cent. platinum. Rhodium was less pure, containing scarcely 98·4 per cent. of the pure metal; impurities were: 1·5 per cent. of iridium, 0·1 per cent. of ruthenium, and a trace of platinum; another specimen, however, contained only 0·4 per cent. of iridium and a third, only 0·05 per cent. of platinum.

The persistence with which iridium adheres to rhodium finds its explanation in the fact that iridium forms a pentammine chloride, isomorphous with rhodiumpentammine chloride, which is the compound used for the purification of the metal in question; the two compounds are only separable, therefore, by frequently repeated crystallisation, that of iridium being the more soluble of the two. The colour of the solution serves as a criterion of the purity of the rhodium compound, as it is colourless when free from iridium; moreover, the impure compound is comparatively readily soluble.

Osmium, hitherto believed to be infusible, may be melted with the help of the electric furnace.

The existence of volatile oxides of osmium and ruthenium renders it easy to obtain these metals in a pure state. Perosmic acid, as sold, is practically pure; perruthenic acid is not sold owing to the readiness with which it undergoes decomposition, but the dioxide may be obtained and converted by fusion with potash and nitre into potassium ruthenate (K_2RuO_4) and the solution of the latter, after treatment with chlorine, yields the pure tetroxide on distillation.

The paper concludes with the description of a method for the detection of the platinum metals when mixed together in presence of others, including gold and mercury; the method, however, is lengthy, and does not lend itself to abstraction. A. L.

Mineralogical Chemistry.

Generalisations on Humous Coal. By C. Eg. Bertrand (*Compt. rend.*, 1898, **127**, 767—769).—The author puts forward a number of generalisations deduced from the microscopic study of specimens of oil shales and bituminous coal. G. T. M.

Salt on Shore of Lake Ruszanda. By Alexander von Kalecsinszky (*Földtani Közlöny*, 1898, **28**, 234—236, 283—285).—The water of the Lake Ruszanda, Com. Torontál, Hungary, is yellowish, and has an alkaline taste and a soapy odour; it is used for baths. On the shore of the lake there is a deposit of whitish salt, a sample of which contained 53·32 per cent. of insoluble matter, mainly sand; the soluble portion contained

Na.	K.	Ca.	Mg.	Fe,Al.	SO_4.	CO_3.	Cl.	SiO_2.	H_2O at 100°.	H_2O on ignition.	Total.
31·744	0·228	0·100	0·055	traces	60·804	2·490	2·828	0·009	0·338	1·441	100·037

This corresponds with 86·86 per cent. of sodium sulphate, 4·07 of sodium carbonate, and 4·66 of sodium chloride. In efflorescences of this kind from other localities, there is usually much more sodium carbonate. An analysis is quoted of the water of the lake, in which sodium sulphate, carbonate, and chloride are present in about equal amounts. L. J. S.

Artificial Production of Lautarite. By August B. de Schulten (*Bull. Soc. franç. Min.*, 1898, **21**, 144—145).—The mineral lautarite, $Ca(IO_3)_2$, occurs in the Chilian nitrate deposits (Abstr., 1892, 124). It is prepared artificially by saturating molten sodium nitrate with amorphous calcium iodate, $Ca(IO_3)_2 + H_2O$. The latter is prepared by heating precipitated $Ca(IO_3)_2 + 6H_2O$ at 100°. The fused mass contains brilliant, monosymmetric crystals of the composition $Ca(IO_3)_2$, which are slightly soluble in water, and have the same habit and angles as the natural mineral; sp. gr. = 4·591. L. J. S.

Artificial Production of Lanarkite. By August B. de Schulten (*Bull. Soc. franç. Min.*, 1898, **21**, 142—144).—Lanarkite is produced by the action of basic lead acetate, $Pb(C_2H_3O)_2,PbO$, on sodium sulphate; when sodium hydroxide is added to a solution of normal lead acetate and the filtrate added to a hot solution of sodium sulphate, a crystalline precipitate having the composition $2PbO,SO_3$, is formed; sp. gr. = 6·923. By diffusion, larger crystals, several millimetres in length, can be obtained, together with crystals of anglesite. The colourless, monosymmetric crystals are elongated in the direction of the axis of symmetry, and have the same habit and angles as the natural crystals. L. J. S.

Cobalt Deposits at Port Macquarie, New South Wales. By John B. Jaquet (*Ann. Rept.* [1897] *Dept. Mines, New South Wales*, 1898, 177—180).—Earthy cobaltiferous wad (asbolite) occurs at Port Macquarie in considerable amount in nests and pockets in serpentine and scattered throughout the red clays which result from the decomposition of the serpentine. It is black to bluish-black (the latter containing more cobalt), with a more or less spongy texture, and a rudely laminated or botryoidal structure. Analysis by H. P. White of a picked sample of ore gave

SiO_2.	Al_2O_3.	Fe_2O_3.	MnO_2.	CoO.	NiO.	Cr_2O_3.	CuO.	CaO.	MgO.
6·40	9·97	16·85	36·50	7·03	2·39	0·40	0·12	1·20	0·83

P_2O_5.	CO_2.	H_2O at 100°.	H_2O combined.	Total.
0·14	0·22	5·38	12·24	99·67

Chrome iron ore is associated with the wad in places. This mode of occurrence is similar to that of the cobalt ores of New Caledonia. The material has probably been segregated during the processes of decomposition of the serpentine. L. J. S.

[Augite] from Kreuzberg, Rhön Mtns. By E. von Seyfried (*Inaug.-Diss. Strassburg*; and *Jahrb. k. preuss. geol. Landesanst.* [for 1896], 1897, 1—38). The Triassic volcanic rocks of this district in Bavaria are described. Analysis I is of augite (after deducting 4·06 per cent. of magnetite and calculating to 100) taken from tephrite, which gave anal. II.

	SiO_2.	TiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	CaO.	MgO.	K_2O.	Na_2O.	Loss on ignition.	Total.	Sp.gr.
I	44·15	—	12·11	—	9·16	20·50	9·80	0·85	3·43	—	100·00	3·46
II	53·26	0·31	16·63	8·29	3·21	7·30	1·10	3·54	5·31	1·43	100·38	2·671

Analyses are also given of nephelite-basalt, basanite, and felspar-basalt. L. J. S.

Differentiation in Igneous Magmas as a Result of Progressive Crystallisation. By J. J. Harris Teall (*Rept. Brit. Assoc.*, [for 1897], 1898, **67**, 661—662; and *Quart. J. Geol. Soc.*, 1897, **53**, 482—488).—Crystal building in a homogeneous igneous magna necessarily produces differentiation into portions of different chemical composition. Usually iron ores are the first, and quartz the last, to crystallise out; but in the basalts of Franz Josef Land, the magnetite is the last to separate, and the mother liquor remaining after the labradorite and augite have crystallised is, therefore, more basic. Analysis of the palagonite representing this basic residue gave

SiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	CaO.	MgO.	Na_2O.	K_2O.	H_2O.	Total.
35·48	8·30	12·30	14·60	1·04	7·10	3·92	trace	16·80	99·5

The progressive crystallisation has here given rise to a concentration of iron and of magnesia and a reduction of silica, alumina, and lime in the mother liquor; and in dykes the more basic portion would be in the centre instead of at the margins, as is more usually the case.

The palagonite results from the alteration of brown glass; it is interstitial between the labradorite (sp. gr. = 2·7) and augite, and also fills amygdales in the vesicular basalts. It is a soft, black or greenish-black substance, sp. gr. = 2·4, and is readily attacked by hydrochloric acid, leaving a white, siliceous skeleton. Under the microscope, in very thin sections, it is doubly refracting and appears to be formed of minute interlacing fibres or scales of a brown, or rarely green, substance. In composition, it differs from hullite and other palagonites, in that much of the iron is ferrous. L. J. S.

Rocks from Franz Josef Land. By E. TULLEY NEWTON and J. J. HARRIS TEALL (*Quart. J. Geol. Soc.*, 1898, **54**, 646—651. Compare preceding abstract).—The common type of basalt of wide distribution in Franz Josef Land consists of labradorite, augite, magnetite, rarely olivine, together with interstitial matter and various secondary products. Analysis by Teall gave

SiO_2.	TiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	MnO.	CaO.	MgO.	K_2O.	Na_2O.	H_2O.	Total.
47·28	1·48	13·24	4·44	10·50	0·40	11·04	5·94	0·31	2·62	2·00	99·25

This agrees very closely with analyses of basalt from Iceland.

L. J. S.

Water of the Illyés Lake, Hungary. By BÉLA LENGYEL (*Földtani Közlöny*, 1898, **28**, 229—234, 280—282).—Three lakes in the salt district near Szováta, Com. Maros-Torda, Transylvania, were formed in 1875—9 by subsidences consequent on the removal by springs of material from the salt-bearing strata. The water in these lakes is used for baths; it is very heavy, and has a temperature of 60° at a depth of 3—4 metres. On the surface is a layer of cold, fresh water brought in by streams. 1000 grams of water from the Illyés Lake contains: Na, 91·23003; Ca, 0·60061; Mg, 0·07109; Fe, 0·00622; Cl, 140·70685; Br, 0·00759; SO_4, 1·01750; CO_3, 0·09800; SiO_2, 0·009. Total: 37233·74726 grams. L. J. S.

Physiological Chemistry.

Temperature of the Human Body. By MARCUS S. PEMBREY and B. A. NICOL (*J. Physiol.*, 1898, **23**, 386—406).—A large number of observations on two healthy men are given. The temperature was usually taken of the stream of urine, which is a trustworthy indication of the internal temperature; the mouth and axilla are not so.

The observations show the diurnal variations of the temperature, but the most prominent feature is the very considerable rise of body temperature that occurs as the result of muscular exercise. Food only causes a slight rise. Mental work has little or no effect.

A simple flat bulb mercurial thermometer gives results which compare favourably with those given by thermo-electric methods of determining the temperature of the skin. W. D. H.

Influence of Antiseptics on the Artificial Gastric Digestion of Fibrin. By Charles F. Mabery and Leo Goldsmith (*J. Amer. Chem. Soc.*, 1897, **19**, 889—894).—The substances tested were alum, cream of tartar, boric acid, and formalin. Alum alone exhibits a marked effect in retarding digestion. W. D. H.

Action of Certain Substances on Digestive Ferments. By Frank D. Simons (*J. Amer. Chem. Soc.*, 1897, **19**, 744—754).—The following substances retard the artificial gastric digestion of proteids: picric acid, tropæolin 000, metanil-yellow. The following retard artificial pancreatic digestion of proteids: bismarck brown, oil of cinnamon, and formol. Gastric digestion ensues only after prolonged treatment if salicylic acid or oil of winter-green is added to the mixture. Both gastric and pancreatic digestion progress normally in the presence of oil of peppermint, chrysoidine, safranine, and methylene-blue. W. D. H.

Ferment Actions of the Succus Entericus. By Friedrich Krüger (*Zeit. Biol.*, 1898, **37**, 229—260).—The bulk of the present paper is occupied with references to past work on the subject of the action of the juice of the small intestine. The remainder describes experiments which confirm the results already well known to physiologists in this country, namely, that the juice does not act on proteids or fats; that it is able to saccharify cooked starch; that it inverts cane-sugar, and has no reverting properties. W. D. H.

Glycocine as an Intermediate Product of Metabolism. By Hugo Wiener (*Chem. Centr.*, 1898, i, 626—627; from *Arch. Exp. Path. Pharm.*, **40**, 313—325).—If more than 0·7—0·8 gram of benzoic acid per kilo. of body weight is given by the mouth to rabbits, the excess is not excreted as hippuric acid, but as free benzoic acid; the maximum amount of glycocine available for the formation of hippuric acid is, therefore, 0·32—0·34 gram per kilo. of the rabbit's body weight. 1·7 gram of benzoic acid per kilo. is fatal; but if glycocine is injected at the same time, this amount can be considerably exceeded without untoward results. Alanine and asparagine do not act in this way, but leucine does; this amido-acid, therefore, yields glycocine as an intermediate product. Feeding with uric acid increases the amount of urea, and also the hippuric acid excreted. W. D. H.

Halogen Metabolism. By F. Blum (*Chem. Centr.*, 1898, i, 992—993; from *Münch. med. Woch.*, **45**, 231—233. Compare Abstr., 1898, i, 287).—Iodothyrin is regarded as an artificial product; it does not occur free in the thyroid. The non-coagulable iodine-containing proteid of that gland is termed *thyrogen*; formaldehyde converts it into a non-coagulable variety called *thyrogen f.* Synthetically prepared iodine compounds of albumin, on treatment with dilute alkalis, or on gastric digestion, yield a product of which the properties are similar to those of iodothyrin. After feeding on the iodine-containing substance of the thyroid, potassium iodide appears in the urine; this is supposed to be formed by oxidation in the body leading to the appearance of nascent iodine. W. D. H.

Formation of Urea from Oxamic Acid in the Organism. By Leo Schwarz (*Chem Centr.*, 1898, i, 951; from *Arch. Exp. Path. Pharm.*, 1898, **41**, 60—73).—Only a small part of the oxamic acid given passes from the body as urea, and there is no formation of oxalic acid; the greater part of the oxamic acid passes unchanged into the urine. Minced liver has not the power to change oxamic acid into urea. W. D. H.

Properties and Formation of Lymph. By Léon Asher (*Zeit. Biol.*, 1898, **37**, 261—306. Compare Abstr., 1898, ii, 239).—Intravenous injection of bile increases the activity of the liver, and causes an increased flow of concentrated lymph from the thoracic duct; this confirms the views previously expressed by the author. After a time, this lymph contains hæmoglobin, but the fluids in the serous cavities and the urine contain no hæmoglobin. This is in favour of the view that the fluids in the serous cavities are not the same as tissue-lymph; possibly they are secretions. Urea which does not plasmolyse blood-corpuscles, like sugar and sodium chloride which do, causes an increase of lymph.

Sometimes the intravenous injection of small quantities of crystalloid materials causes a noteworthy rise in the percentage of solids in the lymph; this cannot be a mechanical result, but is due to the increase in metabolism which is thus set on foot.

Choline causes no increase in bile formation; the lymph also is not more concentrated; but the amount of lymph in the neck and thoracic lymphatics is increased, which corresponds with the fact that choline stimulates secretion in glands. Muscarine behaves in the same way.

Simultaneous injection of crystalloid substances and choline causes little or no lessening of the concentration of the lymph.

The results of the intravenous injection of crystalloid substances are thus partly due to physical, partly to physiological factors.

W. D. H.

Action of the Cells of Frog's Lymph on Bacilli. By W. B. Hardy (*J. Physiol.*, 1898, **23**, 359—375).—Measurements show that contact with an oxyphile cell of frog's lymph retards or stops the growth of a chain of *Bacillus filamentosus*. Below 19°, growth is arrested, whilst between 20° and 25° it is only retarded. The cells exert the action by coating the chain with a slime derived from the oxyphile granules. Contact with a hyaline cell, on the other hand, does not necessarily have any effect on the growth of the bacilli, but if the bacillus gets enclosed within vacuoles developed in the cell-substance, then retardation of growth occurs.

W. D. H.

Thiocyanic Acid in Human Saliva. By Friedrich Krüger (*Zeit. Biol.*, 1898, **37**, 6—24).—The quantity of saliva secreted by a man in the 24 hours varies between 250 and 300 c.c., and is not influenced to any important degree by cigarette smoking.

Thiocyanic acid is a normal constituent of the saliva, and is not produced by putrefactive processes, nor by foreign admixture due to smoking. The amount present is independent of age, sex, health, or disease; the saliva of smokers, however, contains two or three times as much as that of non-smokers. W. D. H.

The Number of Red and Colourless Corpuscles and Amount of Hæmoglobin at Different Ages in Man. By WILHELM SCHWINGE (*Pflüger's Archiv.*, 1898, **73**, 299—338).—After birth, the quantity of red corpuscles and of hæmoglobin are at their maximum; these two values soon sink to a minimum, rise during growth, and during adult life show periodic alterations, finally sinking once more towards the end of life. The number of colourless corpuscles behaves in the reverse manner, sinking during growth and adolescence, and rising afterwards. The two sexes differ in that, during puberty, the numbers for the female sex are smaller than those for the male. The differences noted are believed to be parallel to differences in metabolic activity, and correspond with the amount of interchange between blood and tissues. The high percentage of leucocytes in youth illustrates the formation of new formed elements at that period of life. W. D. H.

Comparative Physiology of Digestion. II. Presence of an Enzyme which Dissolves Cellulose in the Secretion of the Liver of the Snail (Helix pomatia). By WILHELM BIEDERMANN and P. MORITZ (*Pflüger's Archiv.*, 1898, **73**, 219—287. Compare Abstr., 1898, ii, 614).—That cellulose is digested in the alimentary canal of many animals is an undoubted fact; in most instances, this is believed to be due to the action of micro-organisms, and although the existence of an enzyme which has the same power has been mooted by several observers, their results can hardly be considered as definite; on the other hand, in the vegetable world, the existence of a 'cytase' appears in many cases to be have been satisfactorily proved. The first part of the present paper is occupied with a lengthy critical discussion of these results.

The secretion of the so-called liver of the snail, *Helix pomatia*, is remarkably rich in proteid material; it converts starch into dextrose, but its most marked characteristic is the possession of a very active cytase, which acts, not only on the more soluble constituents of the cell wall, like the hemicelluloses, but on the more insoluble materials also which have not undergone actual conversion into woody fibre. The products of action on the hemicelluloses are the same as those which are produced by the action of dilute mineral acids on those substances. The secretion was collected from the intestinal canal of the animals; extracts of the liver have no action on cellulose; doubtless, the cytase is preceded in the liver cells by a zymogen, which is not converted into the enzyme during the process of extraction. The ferment resembles that described in the secretion of the crab's 'liver' by acting at a low temperature. The reaction of the juice has been described by some previous observers as markedly acid; this is not so, the acid reaction which can be demonstrated with some indicators is slight, and is due to acid salts; the juice is alkaline to litmus and to lacmoid. The juice has no action on proteids; numerous proteids of both animal and vegetable origin were tried; the observations were made between April and September, but it is possible that at other periods of the year its action may be different. W. D. H.

Fate of Hæmoglobin in the Organism. By Schurig (*Chem. Centr.*, 1898, i, 951; from *Arch. Exp. Path. Pharm.*, 1898, **41**, 29—59).—Injection of 0·5 gram of hæmoglobin per kilo. of body weight in rabbits for 17 days does not lead to hæmoglobinuria, but this condition appears in 6 days after a daily injection of 1 gram. Hæmoglobin is also found in the bile. The urine is dark, but does not contain bile pigment. After the injection, the connective tissues are rich in iron; part of the hæmoglobin is changed into bilirubin by the liver, and part is found in the spleen and bone-marrow as iron compounds, which can be detected microchemically. W. D. H.

Action of Arsenic on Bone Marrow and Blood. By Ralph Stockman and E. D. W. Greig (*J. Physiol.*, 1898, **23**, 376—382).—In healthy animals, arsenic does not increase the number of blood corpuscles nor the amount of hæmoglobin. In pernicious anæmia, it acts favourably by stimulating the red-marrow; it does not, however, affect the real cause of the disease, and is simply a symptomatic method of treatment. W. D. H.

Action of Copper on the Animal Organism. By Herm. Baum and Richard Seeliger (*Chem. Centr.*, 1898, i, 852; from *Zeit. öffentl. Chem.*, **4**, 181—210).—Different preparations of copper have different degrees of toxicity, copper oleate being by far the most poisonous of the compounds investigated; then follow in order, copper acetate, copper sulphate, and "cupro-hæmol"; the last-named has little or no harmful action. The toxic action is mainly on the brain and on metabolism. W. D. H.

Physiological Action of Alkalis and Acids when greatly Diluted. By Jacques Loeb (*Pflüger's Archiv.*, 1898, **73**, 422—426).—It is well known that the activity of spermatozoa and cilia is increased by dilute alkalis; to say that the alkali acts as a stimulus is no real explanation of this fact. Investigations were undertaken to discover whether the stimulus acts by increasing oxidation processes in the living cilia. The infusorian *Paramœcium* was selected for experiment. These animals were divided into three sets—one in distilled water, one in distilled water to which a little akali was added, and the third in distilled water to which a little acid was added; all were placed in an Engelmann's chamber, and a stream of pure hydrogen passed through it. Those in the alkaline solution lived longest; the dilution of the sodium hydroxide employed must be from $\frac{1}{1200}$ to $\frac{1}{1600}$ per cent.; greater dilution gives a negative result, less dilution hastens the death of the *Paramœcium*. Acids in every degree of dilution are very fatal.

In fever, the alkalinity of the blood decreases; whether this is related to the metabolic activity of the febrile state is uncertain, but it is certainly the case that *Paramœcium* lives and moves longer at a temperature of 40° in an alkaline than it does in a neutral or acid solution.

Potassium cyanide kills by preventing the assimilation of oxygen (C. Bernard and Geppert); a trace of alkali, however, added to a fatal solution of this salt prolongs the life of the *Paramæcium* considerably. The same is true for atropine, but veratrine and strychnine are equally fatal in acid, neutral, and alkaline solutions.

Another series of experiments were performed with the larvæ of the sea-urchin. According to Hoppe-Seyler, free oxygen is necessary for embryonic development; in the present research, dilute alkali was added to see if the development and growth of the larvæ were hastened; this was found to be so in a marvellous degree. From such experiments it is inferred that dilute alkalis favour, dilute acids impede, oxidation in the living organism. It is recommended that in transfusion, after severe hæmorrhage, a dilute alkaline solution should be used. Another practical issue appears to be the desirability of administering alkalis in fevers. W. D. H.

Chloride Metabolism in Pneumonia and Acute Fevers. By Robert Hutchison (*J. Pathol. and Bacteriol.*, 1898, **5**, 406—442).—The research confirms the old statement that during an attack of croupous pneumonia the chlorides of the urine are greatly diminished, or may even entirely disappear. There is a true retention of about 2 grams per diem within the body. This lasts until one or two days after the crisis, and is succeeded by an excessive secretion of chlorides. The degree of diminution varies, but has no relation to the intensity of the fever, lung trouble, or to concomitant albuminuria. The phosphates, sulphates, and urea are increased. Decrease of chlorides may occur in other fevers, such as typhus and acute rheumatism, whilst in malaria the chlorides are increased. The presence of abundant chlorides would negative the diagnosis of pneumonia, but diminution of chlorides is not pathognomonic of that disease.

The absorption of chlorides goes on normally in acute fevers, and no vicarious excretion occurs; there is, however, some increase of these salts in the sputum and in the inflammatory exudation. There is no functional disability of the kidneys to explain the decrease in the urine. The chlorides of the blood are lessened, but there is an increase in all the organs and fixed tissues in general, not in any one in particular. Attempts to produce chloride retention in pyrexia by injection of the pneumococcus failed. Views on the cause of the retention of the chlorides are merely speculative, but are discussed fully; it does not appear to be the result of a retention of water.

The increased secretion of chlorides in malaria is due to increase of arterial pressure in the kidney during the pyrexial stage of that disease. W. D. H.

Influence of Experimental Jaundice on the Glycogen of Liver and Muscles. By Friedrich von Reusz (*Chem. Centr.*, 1898, i, 950—951; from *Arch. exp. Path. Pharm.*, **41**, 19—28).—By feeding rabbits on sugar after ligature of the bile ducts, it is found that the sugar is badly absorbed, and, *post mortem*, much is found in the subcutaneous tissues; nevertheless, there are considerable quantities of glycogen in the liver and muscles. Slight diuresis and glycosuria generally occur. Diabetic puncture in these animals causes only slight glycosuria. There is a good deal of fermentative change in the sugar in the alimentary tract. In dogs, ligature of some branches of the bile duct leads to an increase of water, but only to a slight lessening of the glycogen in the icteric portions of the liver. W. D. H.

Chemico-physiological Studies on Phloridzin. By MAX CREMER (*Zeit. Biol.*, 1898, **37**, 59—81. Compare Abstr., 1898, ii, 243).—Of all theories on phloridzin diabetes, the original one of von Mering is the most probable; still a true secretory activity has also to be taken into account. There is no evidence of any increased new formation of dextrose molecules, and it is possible, but not proved, that the rise in the sugar of the blood is due to the dextrose molecules preformed in glycogen. Phloridzin has no special influence on the cells of the mammary gland, in spite of what Cornevin (*Compt. rend.*, **116**, 263) says to the contrary. W. D. H.

Di-iodacetylidene as a Poison. By OSCAR LOEW (*Zeit. Biol.*, 1898, **37**, 222—228).—According to Nef, the substance obtained by the action of iodine on silver acetylide is not di-iodacetylene, but the isomeric di-iodacetylidene, $C:CI_2$. In keeping with this view, the experiments recorded show the intensely poisonous character of this substance to all kinds of animal and vegetable life. A solution of 1 part in 20,000 kills bacteria, moulds, and yeasts. Solutions of 1 in 100,000 kill algæ in a few hours, of 1 in 1,000,000 in a few days. Similar results were obtained in other cases; the amount of dilution necessary varies, but is always very high; these cases include infusoria, flagellata, copepods, nematodes, rotifers, &c. In vertebrate animals, the substance was breathed in the form of vapour, or injected under the skin; here again the small toxic dose is equally remarkable.

W. D. H.

Chemistry of Vegetable Physiology and Agriculture.

Importance of Stereo-chemistry in Physiology. By EMIL FISCHER (*Zeit. physiol. Chem.*, 1898, **26**, 60—87).—The object of this paper is to bring before physiologists the bearing of the author's work, especially on the carbohydrates. Such importance is indicated by the way in which isomerides are affected by micro-organisms and fungi, some being destroyed, and other substances, with a different optical action, being unaffected. W. D. H.

Relation of Oxygen to the Activity of Living Yeast-cells. By HANS BUCHNER and RUDOLPH RAPP (*Zeit. Biol.*, 1898, **37**, 82—142).—An abundant oxygen supply has no really favourable influence on the fermentative activity, as such, of yeast-cells; it leads to an increase in their number, but the gas is as indifferent as hydrogen or nitrogen is towards the ferment-process as such, that is, towards the formation of zymase. Only in pure surface cultures (on sugar-gelatin) is there an increased respiratory decomposition of the sugar by the yeast-cells, accompanied by increased fermentative activity. Mechanical shaking of the yeast-cells beyond a certain point has a harmful influence on them. Zymase is the only active agent in the chemical changes produced by yeast. W. D. H.

Composition of Buchner's Yeast Extract. By AUGUSTIN WRÓBLEWSKI (*Ber.*, 1898, 31, 3218—3225).—The proteid substances include invertase and a proteolytic ferment (Abstr., 1898, ii, 246), both of which are probably contained in the same precipitates from the extract as are the proteoses. No ferment capable of decomposing starch could be detected, and the presence of oxydases has not been established with any certainty. The presence of several coagulable proteids has been established by the process of partial coagulation; these separate at 40°, 51°, 56°, 59°, 62°, and 68° respectively. The first proteid is also coagulated by ether at 35°, and does not pass through a Chamberland filter; it seems to be the one which most readily undergoes alteration when the extract is kept. Attempts at fractional salting out with concentrated ammonium sulphate (3·8 c.c. of extract to 6·2 c.c. of sulphate solution) indicate that the proteids which coagulate above 60° are precipitated, whilst the others remain in solution. A complex carbohydrate, small amounts of proteoses, and larger quantities of peptone, and a substance with reducing properties have also been isolated. Tyrosin, leucine, glutamic and other amido-acids, together with glycerol, are contained in the alcoholic filtrate from the peptones. J. J. S.

Action of the Sorbose Bacterium on Aldoses. By GABRIEL BERTRAND (*Compt. rend.*, 1898, **127**, 728—730. Compare Abstr., 1898, i, 530 and 536, and this vol., ii, 44).—When the sorbose bacterium is cultivated in a yeast decoction containing an aldose, it is found that after a time a portion of the sugar has disappeared, whilst a corresponding amount of a monobasic acid has been produced. Three solutions containing 5 grams of arabinose, dextrose, and galactose yielded, after 25 days, 0·74 gram of arabonic acid, 1·27 grams of gluconic acid, and 3·62 grams of galactonic acid respectively. G. T. M.

Action of Ammonium Salts on Aspergillus Niger. By CHARLES TANRET (*Bull. Soc. Chim.*, 1897, [iii], **17**, 914—921. Compare Abstr., 1897, ii, 154 and 338).—The author has already shown that when *Aspergillus niger* is sown in a nutrient solution containing an excess of ammonium nitrate, the mycelium can be made to grow continuously without the formation of spores during as long a period as a month, provided the solution is renewed every day; if, however, this liberal diet is curtailed, or if the temperature is allowed to fall much below 30°, fructification at once sets in. It is now shown that a similar effect is produced by ammonium sulphate and ammonium chloride; on the other hand, ammonium phosphate appears to favour the production of spores. The growth of the mycelium, of which 200 grams can be obtained in 10 days from 400 sq. cm. of surface, is accompanied by the liberation of mineral acids, the ammonia only of the ammonium salts being absorbed by the fungus; the author, therefore, suggests that the large excess of mineral bases in the ash of plants is due to a similar absorption of the bases of the neutral salts, whilst the acids are excreted. Starch is formed in considerable quantities under the conditions described, although it does not appear in ordinary cultures; the quantity, estimated by a colorimetric method, was found to be nearly 5 per cent. of the weight of the mycelium under favourable conditions; traces of starch were also found in the nutrient liquors, together with larger quantities of dextrin and dextrose. When rendered soluble by the action of acids and purified by precipitation with baryta, the starch from *A. niger* gave $[\alpha]_D = +177°$, whilst ordinary starch gave $[\alpha]_D = +185°$; its identity was further established by conversion into dextrose.

When nourished with racemic inositol instead of cane-sugar, the mycelium growth of *A. niger* did not effect the resolution of the optical isomerides, but in ordinary cultures the dextrorotatory form was consumed more rapidly, the liquid in which fructification had taken place becoming lævorotatory. T. M. L.

Fungi. By CHARLES TANRET (*Bull. Soc. Chim.*, 1897, [iii], **17**, 921—927).—When *Aspergillus niger* is macerated successively with water, alcohol, ether, and 5 per cent. caustic soda, and then digested with dilute sulphuric acid at 100° for several hours, an insoluble residue of "fungin" remains. By treating this product a second time with caustic soda (2 per cent.), the author has obtained a residue of pure chitin; the identity of this substance was established by analysis ($C = 46{\cdot}28$, $H = 6{\cdot}63$, $N = 6{\cdot}30$), and also by the formation of glucosamine on heating with hydrochloric acid at 100°, and of chitosan on heating with potash at 170°. Other fungi gave similar results, but in no case was a residue of pure chitin obtained; thus, the chitin of the crab and that from *A. niger* gave 82·5 per cent. of glucosamine hydrochloride, but the residue from *Claviceps purpurea* gave only 47·0 per cent., that from *Polyporus officinalis* gave 40·8 per cent., and that from *Boletus edulis* 39·5 per cent.; yeast, on similar treatment, gave only a minute quantity of insoluble residue, and may, therefore, be regarded as practically free from chitin.

The author applies the name *fungose* to that part of the crude fungin which is soluble in soda; these substances approximate to cellulose in composition, but contain a small and variable percentage of nitrogen; they do not, however, dissolve in Schweitzer's reagent, and give no blue coloration with iodine after treatment with sulphuric acid. Like cellulose, they dissolve slowly in 90 per cent. sulphuric acid and are converted into glucose ($[\alpha]_D = +50°$); by the action of acetic anhydride and sodium acetate, they give di- and tri-acetates which are lævorotatory, whilst the salts are dextrorotatory; they are insoluble in ammonia. The author has examined the fungoses from *A. niger*, *C. purpurea*, *P. officinalis*, and also that from *Saccharomyces cerevisiæ* which has been previously mistaken for cellulose.

T. M. L.

Change in Composition of Oleaginous Seeds during Germination. By LÉON MAQUENNE (*Compt. rend.*, 1898, **127**, 625—628).—It is well known that the germination of many oleaginous seeds is accompanied by an increase in the amount of sugar present, and a decrease in that of the fats; in order to determine whether sugar is elaborated, during this change, from the acid radicle of the fat, and, if so, whether the nature of the latter influences the result, the behaviour, during germination, of seeds of *Arachis* (earth nut) and *Ricinus* (castor oil seed) was studied. The former contains the saturated fatty acid, arachidic acid, whilst the latter contains the unsaturated ricinoleic acid. The seeds were grown in sand at 20—25°, complete analyses being made at different stages of the plant's growth. The results obtained indicate that the amount of oil decreases in both kinds of seed during the whole period of germination; the maximum increase of total carbohydrates present, including "cellulose," occurs after 18 days in the case of *Arachis*, and after 10 days in that of *Ricinus*. In the first case, the increase is 5·6 per cent., and in the second 16 per cent.; the former appears entirely attributable to the glycerol of the oil being transformed into sugar, but the latter involves a transformation of the ricinoleic acid into carbohydrates. The term "cellulose" used by the author denotes that portion of the plant which remains after successive treatment with light petroleum, dilute sulphuric acid, and 10 per cent. caustic potash; it contains, in addition to true cellulose, insoluble substances richer in carbon, which are sometimes nitrogenous. The sugar formed appears to consist principally of glucose, associated, perhaps, with levulose. In the case of *Arachis*, there is an initial decrease in its amount, with a subsequent increase, whilst in the case of *Ricinus*, a very rapid increase first occurs, followed by an equally rapid decrease; in the former case, the increase of "cellulose" is continuous, whilst in the latter it is preceded by a decrease. The amount of nitrogen present undergoes little change.

Generalising from his results, the author considers that the fatty acids are less readily transformed into sugars than acids of the oleic series, and probably take part only in respiratory functions. The change of unsaturated acids, and especially of ricinoleic acid, into sugar, probably depends on the presence in the centre of the acid chain of the allyl grouping, $CH\colon CH\cdot CH_2$; this is liberated by the progressive combustion of the ends, and gives rise, initially, to glycerol, which subsequently undergoes polymerisation. W. A. D.

Absorption of Haloid Potassium Salts by Plants. By E. Demoussy (*Compt. rend.*, 1898, **127**, 771—774).—Terrestrial plants whose roots are immersed in solutions of potassium nitrate or potassium chloride absorb these salts at equal rates (compare Abstr., 1896, ii, 128), and the nitrate or chloride, when once absorbed, is retained by the living protoplasm, so that it cannot be extracted with cold water. Boiling water removes the salt, and the same result is obtained by first killing the plant with ether and then extracting with cold water. Potassium chloride is of far less importance to the plant than potassium nitrate, yet each is absorbed with equal readiness; potassium bromide, which is never found in terrestrial plants, is also taken up by them in a precisely similar manner, when their roots are immersed in its solution. In the case of these three salts, the amount removed from solution by the plant is far greater than that which would have been absorbed owing to transpiration. With potassium iodide, the result is quite different; absorption keeps pace exactly with transpiration, and the salt exerts a toxic effect on the plant. The behaviour of the terrestrial plant towards iodine is contrasted with that of the marine flora, in which this element is an essential constituent of the vegetable tissues. G. T. M.

Absorption of Carbohydrates by Roots of Plants. By JULES LAURENT (*Compt. rend.*, 1898, **127**, 786—787).—Seedlings of maize, when surrounded by an atmosphere deprived of carbonic anhydride, and cultivated in sterilised solutions containing glucose, continue to grow, and after a few weeks exhibit a considerable increase in the weight of dry matter; a duplicate culture, made without glucose and placed under the same bell-jar, shows no appreciable change in weight. The presence of sunlight is beneficial, the increase of weight being less when the plant in the glucose solution is cultivated in the dark. Other carbohydrates, such as cane sugar, dextrin, or starch can be utilised by the plant; the roots have a powerful inverting action on the former, whereas the absorption of dextrin or starch is very slow. The seedlings of various plants, developed in distilled water until their reserve material is exhausted, and deprived of starch by cultivation in the dark, are immersed in glucose solutions surrounded by an atmosphere free from carbonic anhydride, and allowed to remain in sunlight during 5 or 6 hours at a temperature of 20—25°; at the end of the time, the leaves are found to contain a notable amount of starch. These experiments indicate that the glucose absorbed by the roots is utilised by the plant in the synthesis of starch, and that green plants assimilate carbon, not only by the agency of chlorophyll, but also by the absorption of certain carbohydrates by their roots.

G. T. M.

Assimilation of Nitrogen as Ammonia and Nitrites by the Higher Plants. By LAURENT, EM. MARCHAL, and CARPIAUX (*Bied. Centr.*, 1898, **27**, 821—823; from *Bul. Acad. Belg.*, 1896, **32**, 815—865, and *Bot. Centr.*, 1897, **70**, 232).—The object of the experiments was to ascertain whether, in the case of higher plants, the presence of light is necessary to enable ammonia and nitric nitrogen to be assimilated.

Various plants were kept, with and without light, in distilled water, and in ordinary nutritive solutions containing ammonium sulphate and potassium nitrate respectively, and pure saccharose (4 per cent.). The organic nitrogen, and the nitrogen as ammonia and as nitrates, were determined after several days.

It was found that assimilation only takes place in presence of light. Leaves free from chlorophyll assimilate ammonia vigorously, but not nitrates to any extent; with chorophyllous leaves, the reverse is the case.

Assimilation of nitrogen depends entirely, or almost entirely, on the ultra-violet rays; when the light passed through a 0·2 per cent. solution of quinine sulphate, assimilation of nitrogen ceased.

N. H. J. M.

Degeneration of Cattleya. By **Alexandre Hébert** and **Georges Truffaut** (*Bull. Soc. Chim.*, 1897, [iii], **17**, 712—718).—*Cattleya*, when grown under the usual artificial conditions, quickly becomes less vigorous, and in the course of a few years no longer affords saleable blossoms. The authors have compared the composition of plants grown under natural and under artificial conditions, before and after flowering, as well as that of the blossoms themselves. The cause of the degeneration seems to lie in the fact that the flowers contain a higher proportion of nitrogen, phosphorus, calcium, and magnesium than does the rest of the plant, and, in consequence of this, the necessary amount of these constituents in the plant diminishes rapidly with the successive flowering, as they are not supplied by the sphagnum and polypody on which the orchid is usually grown. A. L.

Phosphoric Acid in Barley and Malt: Presence of Organic Acids in Malt. By **Charles G. Matthews** and **G. H. Woolcott** (*J. Fed. Inst. Brew.*, 1898, **4**, 6—20).—The authors find that there is a rough relationship between the soluble phosphates of malt and the acidity of the extract, a high acidity as a rule accompanying a high percentage of soluble phosphates; for the estimation of the latter, the malt extract is evaporated to dryness with some lime, the residue charred, and the phosphoric acid determined by the molybdate method. In determining the acidity of malt worts, rosolic acid and litmus give practically the same results, but phenolphthalein gives values which are often four or fives times as high, since it is not affected by the secondary phosphates, which are alkaline to rosolic acid; phenolphthalein is, therefore, to be preferred. The authors confirm Prior's statement that there is no connection between the acidity of malt and the total phosphoric acid. Numbers are given showing the percentages of calcium and magnesium in cold-water extracts of malt and in worts.

By extracting malt with alcohol, the authors only obtained 0·024 per cent. fixed acidity and 0·0054 per cent. volatile acidity, calculated in both cases as lactic acid. Butyric, lactic, and succinic acids were identified in the extract. There can, therefore, be no doubt that the acidity of malt is almost entirely due to the presence of acid salts, as Fernbach and others have suggested. A. C. C.

Carbohydrates of Barley and Malt with special reference to the Pentosans. By **Bernhard Tollens** (*J. Fed. Inst. Brew.*, 1898, **4**, 438—454).—The author reviews the present state of knowledge in connection with the nature of those carbohydrates of barley and malt which yield pentoses and furfuraldehyde on boiling with dilute acid. He is of opinion that in addition to pentosans, the furfuraldehyde-yielding substances of malt contain other compounds which are more susceptible of fermentation than arabinose and xylose, and which do not contain the methylene group, as suggested by Cross and Bevan, since they do not give the characteristic reaction with phloroglucinol and hydrochloric acid. A. C. C.

Composition and Feeding Value of French Haricots. By **Balland** (*Compt. rend.*, 1898, **127**, 532—534).—The author has analysed haricots grown in sixteen departments of France in the year 1897. The mean weight of 100 beans varied from 23·80 to 98·70 grams, and the percentage of husk varied between 6·2 and 9·2. The extremes of composition in the natural state were: water, 9·00 to 14·40; nitrogenous matter, 17·02 to 22·70; fat, 1·10 to 1·90; sugar and starch, 52·22 to 62·56; cellulose, 2·15 to 6·65; ash, 2·25 to 6·65; or in the dry state, nitrogenous matter, 19·61 to 25·80; fat, 1·26 to 2·16; sugar and starch, 61·00 to 71·52; cellulose, 2·50 to 7·57; ash, 2·61 to 7·77.

If the haricots are to be kept for a long time, they must not contain more than 12 to 14 per cent. of water when gathered, and must only be harvested during dry weather. The smaller varieties are generally more nitrogenous, and lose their excess of water more quickly, than the larger beans. C. H. B.

Nitric Nitrogen produced by the Pea. By Jasper L. Beeson (*J. Amer. Chem. Soc.*, 1898, **20**, 793—795).—Samples of soil were taken from small plots, on which various plants were growing, at the end of September, after about six weeks of dry weather, and the nitric nitrogen determined. The following amounts of nitrogen per million of soil were found.

Fallow.	Peas (1).	Peas (2).	Peas (3).	Maize and peas.	Maize.	Cotton.	Sorghum.
1·01	3·33	8·67	10·51	7·50	0·34	0·42	0·33

Peas (1) had pods nearly grown, (2) had pods nearly ripe, and (3) had been dead two or three weeks. The cotton and sorghum were still growing, but not the maize.

It is concluded that the nodule bacteria assimilate more nitrogen than the plant requires, and that peas growing with another crop would tend to increase the yield of that crop, provided that they were not too thick to check the root development, or use up too much soil moisture. It is suggested that the nodule bacteria may possibly continue to assimilate nitrogen after the death of the plant as long as there are any juices left in the plant.

The soil was a very productive, rich bottom land. N. H. J. M.

Nitrification in Soils. By Th. Schlœsing, jun. (*Compt. rend.*, 1897, **125**, 824—827).—Whilst the fact that nitrification is less vigorous in heavy than in light soils is usually attributed to insufficient aëration, the author's experiments indicate that, in many cases, at any rate, it is not a deficiency of air but of water which retards nitrification.

Artificial soils, to which ammonium sulphate was added, were kept in flasks for 2½—3½ months, and the nitric nitrogen determined. The sand and clay together amounted in each case to 100 grams. In the following summary, the amount of sand is given (in grams), and the percentage amounts of nitrogen which was nitrified. The chalk which was added was 0·5 gram (Nos. 1—5 and 12—15), and 1·0 gram (6—11). Flasks 1—5 had 0·05; 6—11, 0·1; and 12—15, 0·0666 gram of ammonium sulphate.

No.	Sand.	Water.	N. nitrified
	Grams.	Grams.	Per cent.
1.	100	10·0	83·0
2.	90	10·0	94·0
3.	80	10·0	89·0
4.	75	10·0	56·0
5.	70	10·0	10·0
6.	100	9·5	63·0
7.	90	9·5	66·0
8.	85	9·5	94·0
9.	80	9·5	100·0
10.	75	9·5	21·0
11.	70	9·5	2·7
12.	70	10·6	80·0
13.	70	11·5	100·0
14.	70	13·2	100·0
15.	70	14·0	100·0

In Nos. 1 and 6, nitrification was incomplete, nitrous acid being present; 9·5 to 10 per cent. of water is probably too much for pure sand, and by occupying too much space hindered aëration.

The very incomplete nitrification in Nos. 4, 5, 10 and 11 could not have been owing to want of air, as the soils were, in each case, quite permeable; moreover, in Nos. 13—15, which contained 30 per cent. of clay, and more water, the whole of the ammonia was nitrified. The failure in the cases mentioned must therefore be ascribed to insufficient water in presence of 25—30 per cent. of clay. With regard to the remarkable effect brought about by a slight increase in water or a slight decrease in clay, it is suggested that the conditions under which nitrification was diminished were owing to the limit having been exceeded, below which the capillary attraction, which retains the water and dissolved substances on the soil, become, nearly everywhere, superior to the osmose which caused the water to penetrate the cells of the microbes, and thus rendered them unable to obtain food from the soil. The results have an important bearing on the question of nitrification in heavy soils. N. H. J. M.

Humates and Soil Fertility. By E. F. Ladd (*J. Amer. Chem. Soc.*, 1898, **20**, 861—867).—The following summary gives the lowest, highest, and average percentage results obtained with 24 North Dakota soils.

	In soil (total).						In Humus.			
	Humus.	Humates.	N.	K_2O.	CaO.	P_2O_5.	N	K_2O.	CaO.	P_2O_5
Lowest	3·84	1·56	0·180	0·18	trace	trace	0·041	0·075	0	0·086
Highest	15·26	7·90	0·456	0·73	2·70	0·40	0·362	0·233	1·03	0·199
Average	9·15	4·77	0·292	0·409	0·944	0·269	0·163	0·153	0·436	0·138

Assuming the weight of an acre of soil to the depth of 1 foot to be 2,225,000 lbs., the total nitrogen will amount, on the average, to 6,497 lbs., the nitrogen in humus to 3,627 lbs., and the phosphoric acid to 5,985 and 3,061 lbs.

As regards the effect of continuous cropping on soils, ordinary analyses of new, unbroken prairie soil and the soil of an adjoining field which had been cropped 17 years (chiefly wheat) gave very little indication as to the cause of the marked decrease in produce which was observed. The amount of humus was found to be unusually low for North Dakota (2·53 per cent.), and by continuous cropping it had been reduced by 39 per cent.

A field which had been cropped continuously for 15 years (wheat) was afterwards rendered more fertile by a system of crop rotation. During 8 years of rotation, the humus increased 46·9 per cent., whilst the phosphoric acid in the form of humates increased 48 per cent.

N. H. J. M.

Efficacy of Various Manures. By H. STEFFECK and MAX MAERCKER (*Jahrb. agrik.-chem. Versuchs-Stat. Halle a-S.*, 1896, 2, 105—131).—*The Nitrogen and Phosphoric Acid of Fish Guano.*—Two different Norwegian fish guanos were employed for the experiments, containing N = 11·81 and 9·27, and P_2O_5, 4·51 and 12·06 per cent. respectively. With both barley and oats, the more nitrogenous guano gave much the best results. In the case of barley, the yield was almost as great as when the same amount of nitrogen in the form of nitrate was given, whilst the barley produced was less nitrogenous. The low percentage of fat in the guano (1·77—1·84 per cent.) was favourable. As regards the effect of the phosphoric acid, it was found to be about equal to 60—70 per cent. of phosphoric acid soluble in water for the first crop.

Ammonium and Potassium Phosphates.—As a nitrogenous manure, ammonium phosphate acted in a manner quite similar to ammonium sulphate with both oats and barley, both as regards yield and nitrogen-content of the grain. The effect of the ammonium salt as a phosphate corresponded with only 88·33 per cent. of that of phosphoric acid soluble in water, whilst potassium phosphate was exactly equivalent to a super-phosphate.

Bone Meal.—The bone meal was treated with only sufficient sulphuric acid to combine with the calcium present as carbonate, and to form dicalcium phosphate. As a manure, the product equalled, the first year, phosphoric acid soluble in water, and the after effect was greater than that of basic slag. It is thus possible to obtain an excellent manure from bone meal at a slight expense. Four manufactured products contained total P_2O_5, 19·17—24·25; P_2O_5 soluble in water, 2·10—5·44; P_2O_5 soluble in citrate (excluding soluble in water), 9·80—20·25 per cent.

Stone Meal.—The phosphoric acid of stone meal was found to be entirely without effect. The potash is quite insufficient for a crop, even with an application of 100 cwt. per hectare, whilst smaller amounts are injurious, as they induce a certain amount of development in the plants which cannot be maintained.

Effect of Extracting the Fat from various Nitrogen Manures.—The manures were meat meal, fish meal, and poudrette. In the case of meat meal, the result of removing the fat was to increase the manurial effect by 17·1 per cent., whilst 16·3 per cent. more nitrogen was taken up by the plants (white mustard). With fish meal, the effect was almost as great as regards the increased amount of nitrogen assimilated. In the case of poudrette, the yield was raised only 5·7 per cent., and the nitrogen taken up was increased by 7·2 per cent. Fish meal, freed from fat, was found to be equivalent to 81·6 per cent. of the value of nitrate, and meat meal to 73·1 per cent. of nitrate. The effect of the residue on the second crop was very slight.

Various Nitrogenous Manures.—A process has been proposed for converting nitrogenous refuse, such as hair, leather, and wool, &c., into a satisfactory manure, by heating 500 parts with a solution of potash (50 parts) containing lime (50 parts) in thin layers, first in a current of carbonic anhydride and afterwards in steam. Slaughter-house refuse thus treated gave very satisfactory results with oats, and especially with barley, whilst refuse from tanned skins gave still better results. Leather refuse was unsatisfactory.

Experiments made with some new guanos are also described.

N. H. J. M.

Proteids of Cream. By E. F. Ladd (*J. Amer. Chem. Soc.*, 1898, **20**, 858—860).—Casein was precipitated by adding a saturated solution of alum (3 c.c.) to 10 grams of cream diluted with water (80 c.c.); after 10 minutes, the solution was filtered, and the precipitate washed with water. The albumin was next separated by heating the filtrate to boiling, and filtering after a few minutes. The filtrate from the albumin was evaporated to about 50—60 c.c., and the albumoses precipitated by saturating with zinc sulphate. After 10—12 hours, it was filtered, the precipitate well washed, and the nitrogen determined. The peptones were determined in the filtrate by evaporating to a small bulk, when a portion of the zinc salt separated, and then adding absolute alcohol to 80 per cent. of the volume; after 12 hours, it was collected, washed with alcohol, and the nitrogen determined. As a check, the total nitrogen of the cream was also determined.

The following percentage results, obtained with (1) fresh cream and (2) ripened cream, are given.

	N in casein.	N in albumin.	N in albumoses.	N in peptones.	Total.	N in cream.
1.	0·237	0·035	0·031	0·023	0·326	0·335
2.	0·249	0·027	0·033	0·032	0·341	0·344

The results show that the method adopted involves no great losses, and that there is no very marked change in the proteids of cream during ripening. N. H. J. M.

Analytical Chemistry.

Hydrogen Sulphide as a Reagent. By Carl Graebe (*Ber.*, 1898, **31**, 2981—2982).—In the author's laboratory, precipitations with hydrogen sulphide are always carried out in closed vessels; for this purpose, small bottles are employed, into which the gas is passed by a tube, an expansion on which is ground into the neck of the bottle thus preventing all escape of gas into the air. The vessel is not closed until the air above the liquid has become displaced by hydrogen sulphide. The precipitation is accelerated by shaking.

J. J. S.

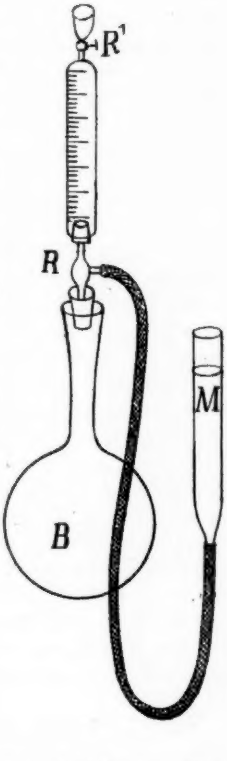
[Estimation of Hydrogen Peroxide.] By Marcellin P. E. Berthelot (*Ann. Chim. Phys.*, 1897, [vii], **11**, 217—222. See this vol., ii, 149).

Estimation of Perchlorate in Chili Saltpetre. By Fr. Freytag (*Chem. Centr.*, 1898, i, 1203; from *Zeit. öffentl. Chem.*, **4**, 321—323).—Ten grams of the sample is heated in a covered porcelain crucible until effervescence has nearly ceased, and the crust formed on the cover is removed and put back into the crucible, which is again heated for 10 minutes. The contents are then dissolved in water, the solution acidified with pure nitric acid, boiled for 10 minutes, and the total chlorine estimated by Volhard's process.

From this is deducted the chlorine present as chloride estimated in 10 grams of the sample by Volhard's process, and the difference is then calculated to potassium perchlorate. Allowance should be made for traces of iodate, if present. L. de K.

Estimation of [Dissolved] Oxygen in Water. By A. Florence *Chem. Centr.*, 1898, i, 474; from *Rép. Pharm.*, 1897, 385).—The round-bottomed flask B is filled with the sample of water and at once closed with a perforated indiarubber cork, fitted with a three-way stopcock, R. By means of the latter, B is connected at will with a graduated burette, furnished with a stopcock R′, or, by means of an indiarubber tube, with the cylinder M, filled with mercury. By lifting M and opening R′ the burette is filled with mercury. R′ is then closed and M is lowered, which causes a vacuum in the burette. By turning R, the communication between the burette and M is intercepted, and established with B instead; the dissolved gas is now given off, and this may be accelerated by gentle warming. When no more gas is given off, the burette is again connected with M, the mercury in the two tubes is levelled, and the volume of gas is read off. After removing any carbonic anhydride by means of aqueous potash, the volume of oxygen is determined as usual by absorption with alkaline pyrogallol.

By means of this apparatus, estimations may be made in a very short time; this is very important, as the amount of dissolved oxygen may rapidly diminish owing to the action of bacteria. L. de K.



Distinction between Ozone and Nitrous Acid or Hydrogen Peroxide. By G. Erlwein and Theodor Weyl (*Ber.*, 1898, 31, 3158—3159).—Ozone produces a wine-red coloration with a solution of metaphenylenediamine, both in presence of acids and alkalis. Since neither nitrous acid nor hydrogen peroxide produces any coloration with the diamine in presence of caustic soda, this reagent may be employed for distinguishing between ozone, on the one hand, and nitrous acid and hydrogen peroxide on the other. A freshly prepared solution of 0·1—0·2 gram of metaphenylenediamine hydrochloride and 10 c.c. of 5 per cent. aqueous soda, made up to 100 c.c., is recommended as a suitable reagent, 25 c.c. of this giving a yellowish-brown coloration with 0·08 milligram of ozone in 5 seconds. Similar colours are produced with the corresponding ortho- and para-diamines. The authors propose to examine the atmosphere, and a number of animal and vegetable organs, and liquids, for ozone. A. H.

Estimation of Sulphuric Acid. By **Félix Marboutin** and **Adrien Pécoul** (*Bull. Soc. Chim.*, 1897, [iii], **17**, 880—881).—The estimation of sulphuric acid as ammonium sulphate gives accurate results when the evaporation is carried out at 65°, but an increase of weight occurs when the residue is further heated on a water-bath at a temperature of 85—100°; above this temperature, the weight decreases again, and becomes normal at 120°. The authors regard this increase of weight as due to loss of ammonia and consequent absorption of water by the residual sulphuric acid; in support of this view, they show that the residue, after heating to 85°, has a marked acid reaction.

T. M. L.

Note.—According to Watson Smith (Abstr., 1898, ii, 575), ammonium sulphate is dissociated, on heating, into the acid sulphate and ammonia, and not into sulphuric acid and ammonia. T. M. L.

Delicate Test for Ammonia and Nitrogenous Compounds which readily yield Ammonia. By **E. Riegler** (*Chem. Centr.*, 1898, i, 272—273; from *Bull. Soc. Sci. Bucuresci*, 1897, **6**, 335).—One gram of paranitraniline is dissolved in 20 c.c. of hot water and 2 c.c. of hydrochloric acid; 160 c.c. of water is added, the mixture well shaken, and when cold mixed with 20 c.c. of a 2·5 per cent. solution of sodium nitrite. Should the solution become turbid, it must be filtered.

Ten c.c. of the solution to be tested for ammonia, or compounds, like proteids, &c., which readily yield ammonia under the influence of strong alkalis, is mixed with 10—15 drops of the reagent and 10 per cent. aqueous soda is added drop by drop. In the presence of ammonia, reddish-yellow clouds appear, and, on shaking, the liquid turns yellow, or even red. If now excess of sulphuric acid is added, the colour vanishes, but on the surface of the liquid microscopic, yellow needles appear, which are soluble in alcohol, the solution giving an intense reddish-violet colour with aqueous soda. L. de K.

Phosphorised Oil. By **H. Ekroos** (*Arch. Pharm.*, 1898, **236**, 627—635).—Both Dusart-Blondlot's method and the bromine method for the estimation of elementary phosphorus in phosphorised oil give results which are about 50 per cent. too low.

Phosphorised oil contains a portion of the dissolved phosphorus in the elementary condition, and a portion in the combined state, which is only slightly oxidised by bromine or nitric acid, is not volatile with steam, and of which the amount increases with the length of time the oil is kept. It seems probable that the phosphorus is combined with the fatty acids of the oil, but this could not be definitely proved.

A. W. C.

Detection of Phosphorus in Insoluble Substances by Sterelectrolysis. By François Mayençon (*Chem. Centr.*, 1898, i, 904; from *Rev. Techn.*, 1897, 398).—The process, which is applicable to phosphides and insoluble phosphates, is based on the liberation of phosphorus by the galvanic current, a sheet of platinum, zinc, or silver serving as anode. The substance is put on a piece of filter paper covering the anode, moistened with water or brine, and connected for a short time with the cathode; the liquid will then give the reactions for phosphoric acid. Or the substance may be moistened on a platinum foil with a few drops of molybdenum solution; the foil is then connected with the positive pole, and when the circuit is closed a yellow spot will make its appearance. L. de K.

Detection of Arsenic in Coal-Tar Colours. By Alfred Ortmann (*Chem. Centr.*, 1898, i, 998—999; from *Zeit. Nahrungsm. Hyg. Waar.*, **12**, 85—91).—Five grams of the dried colour is introduced into a tubulated retort, 5 c.c. of strong ferrous chloride added, and a current of pure hydrogen chloride is passed through the gently heated mixture; the vapours evolved are passed first through a Liebig's condenser, and then through a receiver containing water. After an hour's action, the distillate is introduced into the Marsh's apparatus, but should it contain sulphurous anydride this is first oxidised by potassium chlorate and the excess of chlorine expelled by heating on the water-bath.

Or 5 grams of the sample is heated in a Kjeldahl flask with fuming nitric acid and evaporated to dryness; a mixture of 1 part of potassium sulphate and 2 parts of sulphuric acid is added, and the whole boiled until nearly colourless. When cold, the mass is dissolved in a little water, and then tested in the Marsh's apparatus. L. de K.

Volumetric Estimation of Boric Acid. By H. Copaux (*Compt. rend.*, 1898, **127**, 756—759).—A known quantity of a soluble borate dissolved in a few c.c. of water is titrated with standard sulphuric or hydrochloric acid, using methyl-orange as indicator; the amount of acid required is a measure of the base combined with the boric acid; two volumes of an alcoholic solution of glycerol are now added, and the solution is titrated with N/4 caustic soda (free from carbonate) in the presence of phenolphthalein. The latter titration is repeated, under similar conditions, with a solution of pure boric acid and glycerol; the amount of boric acid in the soluble borate is determined from a comparison of the results. Solutions of soda and boric acid in ethylic alcohol may be employed, and the author applies the method to the estimation of boric acid in its alkylic salts; methylic alcohol, however, must be absent, as it interferes with the end-point.

G. T. M.

Estimation of Carbon in Cast Iron and Steel. By Henryk Wdowiszewski (*Zeit. anal. Chem.*, 1898, **37**, 742).—The dissolution of iron in cuprammonium chloride and the subsequent dissolution of the precipitated copper are tedious operations if allowed to proceed in repose, but by vigorous skaking they can be greatly accelerated. The author employs a conical flask of 250—300 c.c. capacity, with a well fitting stopper held down by a clip. In this is placed the weighed metal with 50 c.c. of copper solution for each gram of iron present, and the stoppered flask is immediately shaken in a shaking apparatus; the operation is complete in 5—8 minutes, and the carbon is obtained in a condition in which it can readily be collected and washed.

M. J. S.

Estimation of the Alkaline Earths without previous Separation. By JOHANNES KNOBLOCH (*Zeit. anal. Chem.*, 1898, **37**, 733—740). —In consequence of the unsatisfactory character of all methods which depend on the complete separation of the three alkaline earths from one another, the author re-advocates the method of indirect estimation, and gives the preference to that form in which the mixed carbonates are weighed and then converted into oxides. This is effected by fusing the carbonates with borax which has first been heated to a constant weight in a platinum crucible (employing a Bunsen flame and a fire-clay crucible-jacket).

Putting p for the weight of the carbonates, and n for that of the oxides.

$2{\cdot}00652915p - 2{\cdot}58283141n =$ the CaO present when the other metal is barium.

$2{\cdot}77369366p - 3{\cdot}95263432n =$ the CaO present when the other metal is strontium.

$7{\cdot}2546326p - 9{\cdot}33816773n =$ the SrO present when the other metal is barium.

If the three metals occur together, the indirect method requires to be supplemented by the direct estimation of the barium; the solution containing the neutral chlorides of the three metals is divided into two portions, in one of which the barium is precipitated as chromate with the precautions laid down by Fresenius (Abstr., 1891, 110, 500; 1893, 436); in the other, the three metals are thrown down as carbonates, and the values p and n (calculated on the total original solution) ascertained as above. Then putting r for the weight of the barium chromate (also in the total solution),

$\mathrm{CaO} = 2{\cdot}77369366p - 3{\cdot}95263432n + 0{\cdot}23080504r.$

$\mathrm{BaO} = 0{\cdot}60367371r.$

$\mathrm{SrO} = n - \mathrm{BaO} - \mathrm{CaO}.$

The test analyses communicated show that fairly close results are obtainable.

M. J. S.

Detection of Cadmium in Presence of Copper by Adsorption. By HEINRICH TREY (*Zeit. anal. Chem.*, 1898, **37**, 743—747).— The author has devised a simple piece of apparatus, for the application of the principle first studied by Schönbein in 1861, that when a dilute solution containing several soluble substances is allowed to rise by capillarity in a piece of filter paper dipped into the liquid, the soluble substances are not only withdrawn by the paper from the water, but are arrested at different distances from the surface of the liquid. A narrow piece of glass-tube has one end widened into a funnel, and the other drawn out to a capillary point; the tube is then bent into a U form, and fixed with its open ends upwards. The solution can then be introduced by the funnel, and when it reaches the capillary point a disc of filter paper can be brought in contact with the point, by resting it on a light wire frame, and allowed to remain until it has absorbed enough of the solution to form a wetted spot of any desired diameter. Solutions containing copper and cadmium are treated with excess of ammonia, and then diluted until the blue colour is scarcely visible. One of Schleicher's ash-free filters is allowed to absorb enough of the solution to wet the paper to a distance of 2·5 cm. from the capillary tube, and is then exposed to the vapour of ammonium sulphide, when the central black spot will be surrounded by a yellow ring of cadmium sulphide, the width and intensity of which will depend on the amount of cadmium present.

M. J. S.

Detection and Estimation of Lead in Tin-plate and Tinned Foods. By P. CARLES (*Chem. Centr.*, 1898, i, 798; from *Bull. Soc. Pharm. Bordeaux*).—For the estimation of lead in tin-plate, Riche's method is recommended, in which the lead is obtained as dioxide by electrolysis; this process is not interfered with by the presence of copper, but is rendered irregular by the presence of 5 per cent. of iron, and should more than 10 per cent. be present, the solution retains ferric stannate.

To detect lead in foods, these are burnt in a muffle, the charred mass is powdered and extracted with water to remove chlorides and alkali phosphates, and then burnt, with addition of sulphuric acid. The ash is treated with a mixture of 6 c.c. of nitric acid and 30 c.c. of sulphuric acid in 264 c.c. of water, and the solution submitted to electrolysis.

L. DE K.

Volumetric Estimation of Mercury by Sodium Arsenite. By C. REICHARD (*Zeit. anal. Chem.*, 1898, 37, 749—751).—The oxides of mercury are reduced to metal when heated with an excess of solution of sodium arsenite in excess of sodium hydroxide, with conversion of a corresponding amount of arsenite into arsenate; the unreduced arsenite is then titrated by iodine or permanganate, after filtering hot and washing. The method seems capable of some degree of accuracy.

M. J. S.

Alkalimetric Estimation of Metals. Estimation of Mercury. By HENRI LESCŒUR (*Bull. Soc. Chim.*, 1897, [iii], 17, 706—712. Compare Abstr., 1898, ii, 455).—Mercuric chloride may be estimated by titration with N/10 alkali, phenolphthalein being used as an indicator; it is necessary that the precipitated mercuric oxide should be separated by filtration, in order to minimise the disturbing influence of the mercuric oxide on the dissolved potassium chloride, a condition which is also attained by employing an alkali of N/100 strength. The use of helianthin leads to unsatisfactory results in this particular instance.

In the cases of mercuric sulphate and nitrate, which are only soluble in presence of excess of acid, the estimation of the metal may be accomplished by making two distinct titrations of the solution, one with helianthin in presence of common salt, which gives the amount of free acid, and the second with phenolphthalein alone, which gives the sum of the free acid and that of the mercuric salt itself.

Mercurous chloride, when boiled with alkalis, is decomposed in accordance with the equation $Hg_2Cl_2 + 2KOH = Hg + HgO + 2KCl + H_2O$, a reaction which may be taken advantage of in estimating mercurous salts. The authors recommend the same method for estimating chlorides in certain liquids, mercurous nitrate being used to precipitate the halogen as calomel. For practical details, the original paper must be consulted. A. L.

Volumetric Estimation of Osmium Tetroxide. By EDUARD A. KLOBBIE (*Chem. Centr.*, 1898, ii, 65—66; from *Kon. Akad. Wetensch. Amsterdam*).—Osmium tetroxide may be estimated to 0·01 per cent. by treating its solution in dilute sulphuric acid with potassium iodide solution and titrating the liberated iodine with sodium thiosulphate; four atoms of iodine are liberated by each molecule of osmium tetroxide, osmium dioxide, potassium sulphate, and water being formed. The solution becomes dark green, and, even after remaining for days, no further reduction takes place; osmium dioxide is feebly basic, and probably the green coloration is due to the intermingling of the blue solution of this oxide in sulphuric acid with the solution of iodine.

E. W. W.

Estimation of Organic Matter in Water by Potassium Permanganate. By FÉLIX MARBOUTIN and MICHEL FRANCK (*Bull. Soc. Chim.*, 1897, [iii], 17, 888—890).—The authors show that Lévy's method in use in France gives results twice, or even thrice, as great as those obtained by the modified Forchammer method used in England; the French standard, however, allows twice as much organic matter, and the classification of the waters is consequently the same in both countries. T. M. L.

Assay of Iodoform. By G. MEILLÈRE (*Chem. Centr.*, 1898, ii, 140; from *Anal. Chim. Anal. Appl.*, 3, 153—154).—One gram of the sample is introduced into a flask, or if a solution has to be tested, a suitable quantity is evaporated to dryness in the flask; to this, 25 c.c. of pure nitric acid is added and then 1·7 gram of silver nitrate. The flask, connected with a Liebig's bulb apparatus containing a little silver solution to serve as a trap, is now heated, gently at first, but more strongly towards the end; when no more nitrous fumes are evolved, the liquid in the flask is diluted to 150 c.c. and heated until quite clear. If the liquid in the bulbs is turbid, it must be added to the main bulk of liquid. The silver iodide is collected on a weighed filter, dried at 100°, and weighed. L. DE K.

Analysis of Aqueous Alcohol. By CHESTER B. CURTIS (*J. Physical Chem.*, 1898, 2, 371—375).—If a definite quantity of aqueous alcohol is taken, the amount of toluene that must be added in order to produce a cloudiness increases as the amount of water in the alcohol decreases. The percentage purity of alcohols containing water may, therefore, be determined by titration with toluene. The method of operating suggested by the author for determining the percentage of alcohol (above 85 per cent.) in a mixture containing water, is to pipette off 10 c.c. of the solution, dilute with 1 c.c. water, and add toluene until the mixture clouds and clears at 0°. The following table gives the number of c.c. of toluene required for alcohols differing by one-half per cent. from 85 to 100.

Per cent. alcohol.	c.c. toluene.	Per cent. alcohol.	c.c. toluene.	Per cent. alcohol.	c.c. toluene.	Per cent. alcohol.	c.c. toluene.
85·0	3·40	89·0	4·70	93·0	7·50	97·0	15·75
85·5	3·49	89·5	4·95	93·5	8·10	97·5	17·45
86·0	3·58	90·0	5·20	94·0	8·70	98·0	19·40
86·5	3·70	90·5	5·40	94·5	9·55	98·5	21·50
87·0	3·90	91·0	5·80	95·0	10·60	99·0	23.70
87·5	4·05	91·5	6·15	95·5	11·70	99·5	25·85
88·0	4·25	92·0	6·55	96·0	12·90	100·0	28·00
88·5	4·48	92·5	7·00	96·5	14·25		

It is obvious that the accuracy of the method is greater as the purity of the alcohol increases.

H. C.

Detection of Glucose in Urine by Means of Methylene-Blue. By ALFRED FRÖHLICH (*Chem. Centr.*, 1898, ii, 66—67; from *Centr. inn. Med.*, 1898, No. 4).—Ten c.c. of the urine is first freed from reducing colouring matters by mixing it with 5 c.c. of solution of lead acetate (3—10), and, then, after shaking, with 5 c.c. of basic lead acetate. The filtrate which, if not colourless, should be diluted with an equal bulk of water and treated with a little more solid lead acetate, is then tested for sugar as follows: 5 c.c. is mixed with 5 c.c. of a solution of methylene-blue (1 : 300) and 1 c.c. of 10 per cent. aqueous potash and boiled. If the colour of the mixture fades, sugar is present. As little as 0·04 per cent. may thus be detected.

L. DE K.

Estimation of Sugar in Urine. By W. SCHLOSSER (*Chem. Centr.*, 1898, i, 1209—1210; from *Pharm. Centr.-Halle*, **39**, 259—261).—One hundred c.c. of the sample of urine is fermented with 4 grams of yeast in a long-necked flask closed with cotton wool, the fermentation being started by placing the flask in water of 35—40°; the whole is then kept for 12 hours at a temperature of 20°. After making sure that all the sugar has disappeared, the yeast is allowed to subside, the liquid poured off, the carbonic anhydride removed by agitating the liquid, and the sp. gr. is then carefully taken (D^1). Another 100 c.c. of the sample is mixed with 2 c.c. of a 1·6 per cent. solution of salt, which the author calculates will introduce the same error in sp. gr. as the amount of added yeast does, and the sp. gr. is taken (D^2). The difference $D^1 - D^2$ is then multiplied by $(V_2 : V_1).229$ or $(102 : 100).229 = 233$, in which formulæ V_1 and V_2 represent the respective volumes of the samples, and 229 the factor proposed by Roberts for calculating the amount of sugar from the loss in sp. gr.

If D^1 and D^2 are taken at different temperatures, a correction must be made. If t^1 is the temperature of the urine and salt, t^2 the temperature after fermentation, the difference $t^1 - t^2$ should be multiplied by 0·0002, and the product added to $D^1 - D^2$ when the temperature lies between 15° and 20°. For temperatures between 20° and 25°, the factor 0·0003 should be used. L. DE K.

Estimation of Diabetic Sugars by the Polarimeter, by the Reducing Power, and by Fermentation. By FRÉDÉRIC LANDOLPH (*Compt. rend.*, 1898, **127**, 765—767. Compare Abstr., 1897, ii, 512, and 1898, ii, 148).—The author's investigations on the reducing power, fermentation, and thermo-optical properties of diabetic sugars, and on the appearance of their solutions when viewed through the polaristrobometer render it possible to divide these sugars into three classes which may be useful in the diagnosis of various glycosuric and diabetic affections. G. T. M.

Estimation of Sugar in Meat and Urine. By EDUARD POLENSKE (*Chem. Centr.*, 1898, i, 1071—1072; from *Arbb. Kais. Ges. A.*, **14**, 149—152).—Two hundred grams of finely comminuted meat, after being soaked for half an hour in 600 c.c. of cold water containing a little acetic acid, is heated to boiling, and when cold the mass is pressed through flannel, and then extracted twice more. The sugar is estimated in the united extracts by means of Peska's ammoniacal copper solution. Treatment with lead acetate is not advisable, as this might cause loss of sugar; precipitation by means of alcohol also is unadvisable. The extract is first filtered through paper, animal charcoal is added, and the whole evaporated on the water-bath until about 250 c.c. is left; it is then filtered, the charcoal well washed, and the filtrate again concentrated to 250 c.c. To the liquid, ammonia is added in slight excess, the whole diluted to 300 c.c., and after 15 minutes filtered and neutralised with acetic acid. It is then colourless and well adapted for the titration; it must, however, be borne in mind that urine, and more particularly meat, contains small proportions of reducing substances which in the analysis count as sugar.

It is more difficult to prove the presence of cane sugar, as this becomes partly inverted, whilst some components of the meat extract also suffer inversion when treated with acids. The author has, however, found that this may be reduced to a minimum by using 5 drops of hydrochloric acid for 100 c.c. of liquid, and heating for half an hour only; the extractive compounds, such as glycogen, are then but little affected, whilst the sugar is completely inverted.

The author also recommends Peska's process for the testing of diabetic urine; this should be diluted so as to contain about 0·5 per cent. of sugar. L. DE K.

Polarisation of Honey. By R. FRÜHLING (*Chem. Centr.*, 1898, ii, 305; from *Zeit. öffentl. Chem.*, **4**, 410—412).—The author calls attention to the fact that solutions of honey, when freshly prepared in the cold, show a very abnormal polarisation, caused by birotation. After the lapse of 5—6 hours, the polarisation is normal.

The error caused by this birotation is sometimes very large, and may amount to as much as $-14°$. The author found that the normal polarisation is at once restored by adding to the liquid about 0·1 per cent. of ammonia; basic lead acetate should not be added, but the liquid should be clarified by means of alumina cream. It is also advisable to dissolve the honey first in a little boiling water, as a high temperature destroys birotation. L. DE K.

Estimation of Sugar in Chocolate. By R. WOY (*Chem. Centr.*, 1898, i, 861 ; from *Zeit. öffentl. Chem.*, 4, 224—226).—The process recommended by de Koningh (Abstr., 1898, ii, 314) is accurate, but rather slow, when applied to chocolate, unless the sample is first deprived of its fat. The author now proposes the following process, based on Scheibler's principle of double dilution. A 100 and a 200 c.c. flask are taken ; half the normal weight of powdered chocolate (13·024 grams) is introduced into each, moistened with alcohol, and treated with water at 50° ; after thoroughly shaking to dissolve the sugar, 4 c.c. of basic lead acetate solution is added, and, when cold, the liquids are made up to the mark and again shaken. The filtrates are now polarised in the 200 mm. tube. If a represents the polarisation of the 100 c.c. liquid, b that of the 200 c.c. liquid, and x the volume of the insoluble matter, including the lead precipitate, then the sugar in the 100 c.c. flask is dissolved in $100 - x$ and the other in $200 - x$ c.c. of water. Then $a(100 - x) = b(200 - x)$. L. DE K.

Analysis of Brewing Sugars. By GEORGE H. MORRIS (*J. Fed. Inst. Brew.*, 1898, 4, 162—176).—It is pointed out that, both in commercial glucoses and invert sugars, there is a certain amount of unfermentable matter which reduces Fehling's solution and is optically active. In the method of analysis proposed by the author, a correction is applied for this, and the true percentages of the fermentable sugars (dextrose, levulose, and maltose) are obtained. Details of the analytical methods adopted are given, as well as tables of optical constants and cupric-reducing power. A. C. C.

The Correction for Unfermentable Reducing Substances in Sugar Analysis. By TOM A. GLENDINNING (*J. Fed. Inst. Brew.*, 1898, 4, 363—365).—The author points out that raw cane sugars usually contain unfermentable Fehling-reducing substances, and that this may account partly for the presence of these substances in commercial invert sugars. Analyses are given in which the percentage varies from 0·47 per cent. to 2·64 per cent. This unfermentable matter was slightly dextrorotatory, and had a cupric-reducing power of about 30. A. C. C.

Malt. I. The Ready-formed Sugars of Malt, and the Action of Diastase on Barley Starch. By ARTHUR R. LING (*J. Fed. Inst. Brew.*, 1898, 4, 187—202).—Attention is called to the fact that in the estimation of the ready-formed sugars of malt by the method proposed by Moritz and Morris, the results are vitiated by the diastatic action taking place during the process of extraction. Experiments are described, showing that diastase does act appreciably on ungelatinised barley starch in the cold, but that this action can be entirely arrested by the presence of 0·0073 per cent. of free hydrochloric acid. Owing to the decomposition of organic salts by hydrochloric acid, this reagent cannot be used in the extraction of the sugars from malt. Results of experiments are given, showing that there is no formation of maltose when a solution containing 0·0168 per cent. of potassium hydroxide is used for the extraction, and it is suggested that this might well serve as the basis of a method for the estimation of the sugars existing ready-formed in malt. A. C. C.

Exact Estimation of Total Carbohydrates in Acid Hydrolysed Starch Products. By GEORGE W. ROLFE and W. A. FAXON (*J. Amer. Chem. Soc.*, 1897, **19**, 698—703).—The authors have determined the exact amount of carbohydrate present in solutions of commercial glucose, the specific rotatory power of the samples employed varying from $[\alpha]_{3\cdot86} = 70\cdot5°$ to $[\alpha]_{D3\cdot86} = 164°$. The solutions were evaporated, and the residues dried at 100—120° in a vacuum apparatus, which is a modification of that of Lobry de Bruyn and Van Leent (compare Brown, Morris and Millar, Trans., 1897, 79). When the specific gravity factors (that is, the excess of the specific gravity of a solution containing 1 gram of dry matter in 100 c.c.) are plotted as ordinates against the specific rotatory powers as abscissæ, a straight line is obtained. The authors conclude that, for solutions of acid hydrolysed starch products of sp. gr. varying from 1·035 to 1·045 at 15·5°, the sp. gr. factor (Σ) may be calculated by the equation

$$\Sigma = 0\cdot004023 - 0\cdot000001329\ (195 - [\alpha]_{D3\cdot86}).$$

A. R. L.

Testing Formaldehyde. By CARL E. SMITH (*Chem. Centr.*, 1898, i, 798—799; from *Amer. J. Pharm.*, **70**, 86—94).—The author proposes the following tests for the purity and identity of the "formalin U.S.P." It should contain 35—40 per cent. of formaldehyde, to be estimated by Legler's ammonia process; it should be colourless, transparent, neutral or very faintly acid, and have a pungent odour and caustic taste. The sp. gr. should be about 1·08, and it should be miscible in all proportions with water and alcohol. When heated with ammoniacal silver nitrate or Fehling's solution, a deposit of metallic silver or cuprous oxide is obtained. If 2 c.c. is heated with 2 c.c. of aqueous potash and 0·5 gram of resorcinol, a red colour is developed. If 5 c.c. of sulphuric acid, containing a little salicylic acid, is added to 2 drops of the sample, a permanent dark-red coloration is obtained. If 1 c.c. of the solution is mixed with 5 c.c. of ammonia and evaporated to dryness on the water-bath, a white, crystalline residue is left, which, when heated with dilute sulphuric acid, gives the original pungent odour. One c.c., mixed with 10 c.c. of iodine solution and a sufficiency of aqueous potash, should give no iodoform reaction, showing the absence of acetone. The sample should also be quite free from any mineral matters. L. DE K.

Estimation of Formaldehyde. By OSKAR BLANK and H. FINKENBEINER (*Ber.*, 1898, **31**, 2979—2981).—Three grams of the formaldehyde solution, or 1 gram of "solid formaldehyde," is dissolved in 25 c.c. of 2N sodium hydroxide; if the formaldehyde solution is stronger than 45 per cent., then 30 c.c. of alkali is employed. The mixture is placed in a tall Erlenmeyer flask and 50 c.c. of pure hydrogen peroxide free from acid (2·5—3 per cent.) run in through a funnel during the course of three minutes; the funnel is then washed out with distilled water, and the excess of alkali in the flask titrated with 2N sulphuric acid, using litmus as an indicator. If the aldehyde solution contains less than 30 per cent. of formaldehyde, the mixture must be allowed to remain 10 minutes after the hydrogen peroxide has been run in. The number of c.c. of alkali which have been used up in converting the aldehyde into sodium formate, when multiplied by two, gives the percentage of formaldehyde in the original solution.

The results agree with those obtained by other methods employed in commercial analysis, but give higher values (about 1·5 per cent.) than the ammonia method. J. J. S.

Volumetric Estimation of Acetaldehyde. By Xavier Rocques (*Compt. rend.*, 1898, **127**, 524—526).—The author has modified the method described by Rieter (Abstr., 1897, ii, 606). He finds that alcoholic solutions of sulphurous acids and sulphites are much more stable than aqueous solutions; that alcoholic solutions of alkali-hydrogen sulphites are most suitable for the estimation of aldehyde; that in dilute solutions at least 12 hours is required to ensure complete combination; and that unless the proportion of aldehyde is very small, the sulphite compound is not completely decomposed by potassium hydroxide.

The sulphite solution is prepared by dissolving 12·6 grams of anhydrous sodium sulphite in 400 c.c. of water, adding 100 c.c. of normal sulphuric acid, diluting to 1000 c.c. with alcohol of 96°, and filtering after 24 hours. Ten c.c. of the alcoholic solution of aldehyde to be examined is placed in a 100 c.c. flask, mixed with 50 c.c. of the sulphite solution and made up to 100 c.c. with alcohol of 50°. A second quantity of 50 c.c. of the sulphite solution is placed in a similar flask, and made up to 100 c.c. with the same alcohol. After at least 12 hours, 50 c.c. is withdrawn from each flask, and the sulphurous acid estimated by means of decinormal iodine solution; the difference is the quantity of sulphurous acid that is in combination with the aldehyde; 1 c.c. of N/10 iodine = 0·0022 gram of aldehyde.

If the liquid to be examined contains less than 1 per cent. of aldehyde, the sulphite solution must be diluted; for 0·5 per cent., it should be diluted with an equal volume of alcohol of 50°, and N/20 iodine should be used; for 0·1 per cent., the sulphite should be diluted with alcohol of 50° to 10 times its ordinary volume, and centinormal iodine solution should be used. C. H. B.

Volumetric Estimation of Acetaldehyde. By Xavier Rocques (*Compt. rend.*, 1898, **127**, 764—765. Compare preceding abstract).—The action of alkali hydrogen sulphites on acetaldehyde, when carried out at 15°, is not complete after 48 hours. The solution to be examined should be mixed with a known volume of alcoholic bisulphite solution, made up to 100 c.c. with 50 per cent. alcohol in a stoppered flask, and heated for 4 hours at 50°; a blank experiment should also be performed in another flask containing similar quantities of bisulphite and alcohol, and at the end of the time both solutions should be titrated with iodine in the manner previously indicated. G. T. M.

Detection of Acetone in Urine. By B. STUDER (*Chem. Centr.*, 1898, i, 1152; from *Schweiz. Woch. Pharm.*, **36**, 149—151).—The author combines the methods proposed by Legal, and Lieben and Dragendorff; 50 c.c. of the sample of urine is mixed with 5 c.c. of dilute sulphuric acid and submitted to distillation, the distillate being collected in a test-tube placed in cold water. When 3 c.c. has passed over, 6 to 10 drops of a freshly-prepared 10 per cent. solution of sodium nitroprusside, and 1—2 drops of aqueous soda are added; if acetone is present, a purple-red coloration is produced. If the reaction is not decided enough, it may be advisable to add 6 to 8 drops of acetic acid, when a claret colour will prove the presence of acetone. The reaction is interfered with by hydrogen sulphide, which is occasionally present in stale urines. L. DE K.

Soap Analysis. By RUDOLF HEFELMANN and ERNST STEINER (*Chem. Centr.*, 1898, ii, 142—143; from *Zeit. öffentl. Chem.*, **4**, 389—396).—The estimation of the fatty acids in soaps made from Ceylon oil is attended with some inaccuracies which are avoided by using the authors' process. The fatty acids and other fatty matters are liberated by a mineral acid, and extracted by ether; this solution is neutralised by N/2 potash, using phenolphthalein as indicator, and the whole is dried over a weighed quantity of sand at 100°. The amount of fatty acids and neutral fats may then be easily calculated.

Equally accurate results are obtained by evaporating the ether and drying the residue at 55°; at a higher temperature, some of the fatty acids volatilise. Light petroleum should not be used, as it does not dissolve the acids completely. L. DE K.

Relation between the Sp. Gr. and the Insoluble Fatty Acids of Butter and other Fats. By NORMAN LEONARD (*Analyst*, 1898, **23**, 282—283).—It is well known that animal fats used for making butter substitutes have a much lower sp. gr. than butter-fat itself, and the author states that the relation between the sp. gr. at 100° F. and the percentage of insoluble fatty acids yielded by the sample may be approximately represented by the formula $y = k(1 - x)$, where y is the percentage of insoluble acids, and x the sp. gr. of the melted fat at 100° F., water at 60° F. being taken as unity. k is a constant which may be taken as $= 951$ on an average.

When the butter mixture contains animal fats, the percentage of fatty acids actually found will at the most differ by 1·4 per cent. from that calculated by the formula. But when vegetable oils such as cotton-seed oil, cocoa nut oil, or sesamé oil have been used, the formula will no longer agree. L. DE K.

Chemistry of Drying Oils: Examination of Linseed Oil. By OTTO HEHNER and CHARLES A. MITCHELL (*Analyst*, 1898, **23**, 310—318).—The paper is chiefly devoted to a criticism of the work done by Hazura and Grüssner (Abstr., 1888, 817; 1270). Their results are, on the whole, verified by the authors.

By dissolving 1—2 grams of linseed oil in 40 c.c. of ether and a few c.c. of glacial acetic acid, cooling the mixture in ice, and adding

bromine, a precipitate is obtained which may be collected, washed with cold ether, and finally dried in a water-oven until the weight becomes constant. The process seems a valuable one for the assay of commercial raw linseed oil, as the pure article yields from 24—25 per cent. of brominated deposit, whilst common adulterants such as cotton-seed oil either yield no deposit at all, or but a trifling quantity, as in the case of walnut oil, for instance. Marine animal oils, however, also yield abundant precipitates, and cannot be detected by the bromine test.
L. DE K.

Estimation of Fat in Animal Tissues and Fluids. By JOSEPH NERKING (*Pflüger's Archiv.*, 1898, **73**, 172—183. Compare Abstr., 1898, 413).—This paper is a defence of the method introduced by Dormeyer, who subjects meat, &c., to gastric digestion before extracting it with ether. A new piece of apparatus for performing the extraction is described and figured. Hydrochloric acid has no deleterious action on fatty acids.
W. D. H.

Analysis of Bone Fats. By AL. A. SHUKOFF and P. J. SCHESTAKOFF (*Chem. Centr.*, 1898, i, 864—865; from *Chem. Rev. Fett. ü. Harz-Ind.*, **5**, 5—8).—Moisture is estimated by drying 5 grams of the sample in a current of air, or carbonic anhydride, at 100—110°. Foreign admixtures are found by treating the dried fat with light petroleum, which, however, also dissolves any lime soaps. The ash is obtained by burning the fat, and it is then tested for lime with standard acid. To make a direct estimation of the fatty matter, 10 grams of the sample is mixed with 3—5 drops of strong hydrochloric acid to decompose the lime soaps, and the fatty matter is extracted by means of light petroleum; any insoluble matter is collected on a weighed filter, which is then well washed and the bulk of the light petroleum being distilled off, the remainder is removed by drying the fat as before in a current of carbonic anhydride at 100—110°.

The unsaponifiable matter is estimated by evaporating 5 grams of the fatty matter to dryness with 25 c.c. of 8 per cent. alcoholic soda in a porcelain dish; the soap is dissolved in 80 c.c. of water, and three times extracted with 80 c.c. of ether; if the layers will not separate readily, this may be accelerated by adding a little alcohol. The ethereal solution is evaporated to dryness, and the residue treated with a little aqueous soda and then with light petroleum; the latter, on evaporation, leaves the unsaponifiable matter in a state of purity. The solidifying point is taken according to Dalican's directions.
L. DE K.

Analysis of Fats: Preparation and Crystallisation of Cholesterol and Phytosterol. By A. BÖMER (*Chem. Centr.*, 1898, i, 466—467; from *Zeit. Unters. Nahr. u. Genussm.*, 1898, 21—49).—The author proposes a modification of Salkowski's process. Fifty grams of the fat, melted in an Erlenmeyer flask fitted to a reflux condenser, is saponified with 100 c.c. of 20 per cent. alcoholic potash, the soap introduced into a separating funnel, 200 c.c. of water added, and the whole extracted by shaking with 500 c.c. of pure ether; after removing the ether, the extraction is twice repeated, using 250 c.c. of ether each time. The ether is then distilled off from the mixed extracts, and the residue again saponified with 10 c.c. of the alcoholic potash; 20 c.c. of water is added, and the shaking repeated with 100 c.c. of ether. This, after being freed from traces of soap by washing thrice with 10 c.c. of water, is left to evaporate spontaneously; the residual cholesterol or phytosterol must then be recrystallised from boiling absolute alcohol.

It appears that the microscopical appearance of the two substances depends on various circumstances, but, as a rule, cholesterol forms thin, rhombic tablets, whilst phytosterol yields thin needles. In doubtful cases, the melting point should be taken. If both are present, a kind of mixed crystal is obtained, which looks either somewhat like cholesterol or phytosterol. L. DE K.

Analysis of Fats: Melting Points of Cholesterol and Phytosterol; Amount of Unsaponifiable Matter in Fats. By A. BÖMER (*Chem. Centr.*, 1898, i, 638—639; from *Zeit. Unters. Nahr. u. Genussm.*, 1898, 81—96).—The author estimated the amount of cholesterol in lard and butter-fat by his process (preceding abstract), and obtained, on an average, 0·1774 per cent. of crude cholesterol from lard and 0·3512 per cent. from butter. These figures are higher than those obtained by Salkowski. Cholesterol melts at 146—148°, whilst phytosterol melts at 135·5—141°. Mixtures of the two have a melting point varying but slightly from the calculated figure.

The phytosterol test enables the presence of commercial margarine in butter, or of cotton-seed oil in lard, to be detected with certainty if the chemical analysis of these articles leaves any doubt. It is, however, not so easy to detect small percentages of animal fats in vegetable oils. L. DE K.

Volumetric Estimation of Methylic Salicylate. By EDWARD KREMERS and MARTHA M. JAMES (*Chem. Centr.*, 1898, i, 1070; from *Pharm. Rev.*, **16**, 130—133).—The authors have slightly modified the method proposed by Ewing, and now boil a weighed quantity of the substance with a known volume of normal alkali for 5 minutes. The excess of alkali is then titrated with normal acid, and the alkali consumed, multiplied by 0·152, represents the number of grams of methylic salicylate.

The method proposed by Messinger and Vortmann is also recommended. Five grams of the sample is saponified with excess of alkali, and when cold diluted to 500 c.c.; 10 c.c. of this is heated, 50 c.c. of N/10 iodine solution added, and the liquid diluted to 500 c.c; in 100 c.c. of this, the excess of iodine is estimated by means of N/10 sodium thiosulphate. One c.c. of iodine solution absorbed, when multiplied by 0·631825, represents the amount of methylic salicylate, as 1 mol. of the ethereal salt absorbs 7 mols. of iodine. L. DE K.

Detection of α-Naphthol in β-Naphthol. By A. DUBOSC (*Chem. Centr.*, 1898, i, 800; from *Bull. Soc. Ind. Rouen*, 1897, 434).—If a solution of α-naphthol is mixed with a few drops of sodium hypobromite solution (30 c.c. aqueous soda of sp. gr. = 1·33, 100 c.c. of water, and 5 c.c. of bromine), a dirty violet coloration is produced, but β-naphthol only gives a pale yellow colour. The author now proposes to use this reaction for testing commercial samples of β-naphthol which, should they contain even as little as 3 per cent. of the α-compound, are useless for preparing dyes. L. DE K.

Examination of Camphor Liniment. By NORMAN LEONARD and H. METCALFE SMITH (*Analyst*, **23**, 281—282).—This drug being often deficient in camphor, the authors ascertain the amount present by drying 3 or 5 grams of the sample for 2 hours at 120° in a flat-bottomed dish. The loss, after adding 0·15 per cent. to compensate for the gain in weight caused by the oxidation of the olive oil, should amount to 21·45 per cent.

Assuming the sp. gr. of the olive oil to have been 0·9164, the amount of camphor may be calculated from the sp. gr. of the sample, each per cent. of camphor raising the density by 0·00045. Mineral oil is sometimes employed instead of olive oil, but this fraud is readily detected by the insolubility of the sample in hot alcoholic potash.

L. DE K.

Action of Iodine on Antipyrine. Estimation of Antipyrine or of Iodine. By J. BOUGAULT (*Chem. Centr.*, 1898, i, 858; from *J. Pharm.*, [vi], 7, 161—163).—The author has found that 1 mol. of antipyrine dissolved in alcohol containing mercuric chloride absorbs exactly 1 mol. of iodine; or 1 gram of antipyrine = 1·351 grams of iodine.

To estimate antipyrine, 20 c.c. of a 1 per cent. alcoholic solution is mixed with 20 c.c. of a 2·5 per cent. alcoholic solution of mercuric chloride and an alcoholic solution of iodine containing 1·351 grams of iodine in 100 c.c. of 95 per cent. alcohol is added until a permanent, yellowish coloration is noticed. If the antipyrine is pure, it will consume exactly 20 c.c. of iodine solution; if not, it will take proportionally less. An iodine solution may, in turn, be estimated by means of a standard solution of antipyrine. L. DE K.

Reactions of Alkaloids with Benzaldehyde and Sulphuric Acid. By HERM. MELZER (*Zeit. anal. Chem.*, 1898, **37**, 747—748).—Besides picrotoxin (Abstr., 1898, ii, 651), only a few other alkaloids and poisons produce colours with benzaldehyde and sulphuric acid. It is best to use a 20 per cent. solution of benzaldehyde in absolute alcohol, a drop of this solution being added to a trace of the alkaloid in a watch-glass, and then a single drop of concentrated sulphuric acid without any stirring. Digitalin gives brown streaks; veratrine, a red coloration; codeine, a yellow to blood-red; thebaine, a dark brown; delphinine, reddish-brown streaks; morphine, red to yellowish-red streaks; whilst colchicine, cantharidin, coniine, nicotine, brucine, strychnine, aconitine, papaverine, narcotine, hyoscyamine, emetine, apomorphine, and narceine give no characteristic colours. M. J. S.

Estimation of Nicotine in Tobacco. By C. C. KELLER (*Chem. Centr.*, 1898, ii, 388—389; from *Ber. Deutsch. Pharm. Ges.*, **8**, 145—152).—The author recommends the following process: 6 grams of tobacco dried over quicklime is powdered and treated in a stoppered bottle with 60 grams of ether, 60 grams of light petroleum, and 10 c.c. of 20 per cent. aqueous potash; the mixture is well shaken for half an hour, then left for 3 or 4 hours, and 100 grams of the ethereal liquid is collected in a 200 c.c. bottle; after a strong current of air has been passed through to expel any ammonia present, 10 c.c. of alcohol, one drop of a 10 per cent. solution of iodeosin, and 10 c.c. of water are added, and the whole is well shaken, which causes the iodeosin and the nicotine to pass into the aqueous liquid. N/10 hydrochloric acid is now added until the liquid is colourless, and the slight excess of acid is titrated by means of N/10 ammonia. One c.c. of acid = 0·0162 gram of nicotine.

Analyses are given showing the amount of nicotine in various brands of tobacco and cigars, from which it appears that so-called strong tobaccos do not necessarily contain a high percentage of nicotine. L. DE K.

Estimation of Morphine in Opium. By HERMANN THOMS (*Chem. Centr.*, 1898, ii, 136; from *Ber. Deutsch. Pharm. Gesell.*, **8**, 124—125).—The author condemns the so-called brine method proposed by Montemartini and Trasciatti for the assay of opium (Abstr., 1898, ii, 270) as being too tedious, and giving results which are too low. L. DE K.

Action of Sulphuric Acid on Strychnine when separating this Alkaloid from Organic Matters. By EDGAR H. S. BAILEY and WM. LANGE (*Chem. Centr.*, 1898, i, 478; from *Amer. J. Pharm.*, **70**, 18—21).—The authors find that the treatment with sulphuric acid so modifies the strychnine that it requires more than four times the usual amount to get a satisfactory reaction with the potassium dichromate test. Matters are even worse, if, after the acid treatment, the alkaloid is extracted by means of aqueous potash and chloroform. Minute traces of the alkaloid may, therefore, escape detection altogether. L. DE K.

Estimation of Indigo: Brandt's Method. By ALBERT BRYLINSKI (*Chem. Centr.*, 1898, i, 1041; from *Bull. Soc. Ind. Mulhouse*, 1898, 33—39).—The extraction of indigotin by means of boiling aniline is attended by two serious sources of error; if the extraction is continued for 3—4 hours, about 30—40 per cent. of the indigo may be decomposed; on the other hand, the indigotin crystals retain about 10 per cent. of aniline. As, however, in Brandt's process the boiling only lasts for half an hour, the two errors fairly well compensate one another, so that the result is technically accurate.

The acetic acid process gives almost theoretically correct results. The sample is extracted in a Soxhlet's apparatus with boiling glacial acetic acid until the acid runs off colourless; on diluting the extract with four times its bulk of water, the indigotin is completely precipitated and may be collected on a weighed filter. It is washed first with hot water, and then with alcohol and ether to free it from certain impurities extracted from the paper filter by the strong acid. L. DE K.

Heller's Test for Detecting Blood in Urine. By V. ARNOLD (*Chem. Centr.*, 1898, i, 1002; from *Rev. Klin. Wochschr.*, **35**, 283—285).—This well-known test is based on the fact that aqueous potash, on warming, precipitates the earthy phosphates from urine, which, in the presence of blood, assume a ruby-red colour; the test does not depend on the formation of hæmatin, but of hæmochromogen. As, however, the reaction may be also due to the presence of melanin or urobilin, the author advises not to trust to Heller's test alone, but always to confirm the result by means of the spectroscope. Blood spots may be dissolved in aqueous potash, and urine may then be added; the addition of ammonium sulphide becomes superfluous.

L. DE K.

Guaiacol Test for Blood. By EDUARD SCHAER (*Arch. Pharm.*, 1898, **236**, 571—579).—The author finds that a 65—80 per cent. solution of chloral hydrate is an excellent solvent for blood, and proposes to modify the guaiacol test in the following manner.

The blood stain, after moistening with glacial acetic acid, is treated with a concentrated solution of chloral hydrate. To a small portion of the extract, guaiacol is then added, and either hydrogen peroxide or Hünefeld's reagent, when the blue colour is produced with remarkable delicacy. A. W. C.

Simplified Test for Peptone in Urine. By ERNST FREUND (*Chem. Centr.*, 1898, i, 637; from *Wien. Klin. Rundsch.*, 1898, 37).—The urine is freed from nucleo-albumins, albumin, and protalbumoses by means of a 10 per cent. solution of lead acetate, two drops being generally sufficient for 10 c.c. of urine. Should, however, the urine contain from 0·1 to 3 per cent. of albumin, this must be first removed by coagulation with a few drops of dilute acetic acid at the boiling heat. The filtrate is then carefully neutralised with soda before adding the lead solution. The second filtrate, which should not give any reaction with acetic acid and potassium ferrocyanide, showing absence of excess of lead, is now used for the biuret test. One part of peptone may thus be detected in 12,000 parts of urine.

L. DE K.

Precipitation of Albumoses by Zinc Sulphate. By K. BAUMANN and A. BÖMER (*Chem. Centr.*, 1898, i, 640; from *Zeit. Unters. Nahr. ü. Genussm.*, 1898, 102—126).—The authors state that zinc sulphate may be advantageously used instead of the ammonium salt in the analysis of meat extracts, &c. The solution, which must be free from coagulable albumin and contain about 1 gram of solid matter in 50 c.c., is acidified with 1 c.c. of dilute sulphuric acid (1 : 4) and gradually saturated with zinc sulphate, using very finely-powdered salt towards the finish. The liquid is filtered after being kept overnight, and the precipitate washed with a slightly acidified saturated solution of zinc sulphate. The amount of albumose is then found by treating the precipitate by Kjeldahl's process. In the filtrate, the peptones, meat-bases, and ammonia are precipitated by the ordinary solution of phosphotungstic acid to which half its volume of dilute sulphuric acid (1 : 8) has been previously added.

After being first kept for some time at 60—65°, the mixture is allowed to remain for 24 hours in a cool place; it is then filtered, and the precipitate, after being washed with dilute sulphuric acid (1 : 6), is treated by Kjeldahl's process.

Ammonia may be estimated in a second phosphotungstic precipitate by distillation with magnesia, and must be allowed for when calculating the amount of peptones and meat-bases from the result of the nitrogen estimation. L. DE K.

Detection of Dextrin, Gelatin, and Gum in Desiccated Albumin. By A. A. BONNEMA (*Chem. Centr.*, 1898, ii, 386; from *Pharm Centr.-Halle*, **39**, 424—425).—Ten grams of the powdered white of egg is well stirred with water, boiled to coagulate the albumin, and after a few minutes the liquid is filtered and a portion of the filtrate put aside to cool at a low temperature for 24 hours; if it turns to a jelly, gelatin is present. Another portion is mixed with alcohol in excess, and if a permanent precipitate is obtained, gelatin, dextrin, or gum is present; the former precipitate disappears on adding a little nitric acid. Dextrin may be identified in the filtrate by the red coloration produced with iodine, and gum by the precipitate given with basic lead acetate. Dieterich's iodine absorption test for the purity of albumin is not recommended by the author.

L. DE K.

Estimation of Gelatin in Gums and Food Materials. By AUGUSTE TRILLAT (*Compt. rend.*, 1898, **127**, 724—725).—In estimating the amount of gelatin present in a sample of gum arabic, the substance is dissolved in water, filtered if necessary, evaporated to a syrupy consistency, treated with excess of formaldehyde solution, and the evaporation continued until the mixture becomes pasty; it is then extracted with water to remove the gum and the gelatin rendered insoluble by the aldehyde, is dried at 100° and weighed. The results obtained agree to 1 per cent., and the method serves to distinguish between artificial jellies containing gelatin and those derived from vegetable sources. The increase in weight of the gelatin due to the fixation of formaldehyde is inappreciable, owing to the great difference between their molecular weights. If the sample to be analysed contains proteid substances coagulated by heat, these are first removed by warming the solution; the filtrate should be concentrated before the addition of formaldehyde, as no precipitate is produced in dilute solutions. G. T. M.

General and Physical Chemistry.

Relation between Luminous Energy and Chemical Energy: The Reciprocal Displacement of Oxygen and the Halogens. By MARCELLIN P. E. BERTHELOT (*Compt. rend.*, 1898, **127**, 795—798).—The author has stated (this vol., ii, 1) that both iodic acid and iodic anhydride are slowly decomposed at the ordinary temperature, either by heat or by direct sunlight, into iodine and oxygen; it is now shown that this action is non-reversible, no change appearing to take place when oxygen in contact with iodine, either dry or in presence of water, is left exposed in a sealed tube during 5 months to bright sunshine. Direct combination between iodine and oxygen is impossible, because such a change would be endothermic. Bromine and chlorine do not combine directly with oxygen, but, on the other hand, decompose water with liberation of oxygen; in the case of bromine, the action is hardly perceptible in darkness, but is much more apparent in sunlight. The reaction is, however, reversible, cold concentrated hydrobromic acid being decomposed by oxygen under the influence of sunlight (Abstr., 1890, 6); with dilute hydrobromic acid, however, a similar action occurs only very slowly, if at all. Pure concentrated hydrochloric acid is not acted on by oxygen; if, however, a trace of a metal such as manganese or iron is present, decomposition takes place, chlorine being evolved (*loc. cit.*). W. A. D.

Spectra of Compounds. By ARNAUD DE GRAMONT (*Bull. Soc. Chim.*, 1897, [iii], **17**, 774—778).—In view of the confusion which frequently arises in the discussion of the spectra of compounds, the author emphasises the distinction between *line-spectra*, or *atomic spectra*, due to the elements themselves and probably to the atoms thereof, and *band-spectra*, which are produced by undecomposed compounds, and may, therefore, be termed *molecular spectra.* The spectra consisting of fluted bands, capable of resolution into groups of lines, form a third class, which is not further considered here. Under the ordinary laboratory conditions, when a solution or a fused salt is heated by a Bunsen flame or an electric spark, a mixed spectrum is observed, consisting of the principal lines due to the metal, and of bands belonging either to the salt itself, or to simpler compounds, such as metallic oxides, produced by its decomposition.

To the first class of spectra above mentioned belong dissociation spectra, obtained by means of a condensed electric spark, and consisting of all the lines characteristic of the elements contained in the compound examined. The principal lines, owing to the condensation, are rendered diffuse, so as to have the appearance of bands; this is more especially the case with the non-metallic elements and with the more refrangible rays. A highly condensed spark is, however, favourable to the appearance of the more feeble lines. Dissociation spectra, whether obtained with a solid compound or with a fused salt, exhibit essentially the same characters, except that, in the latter case, the atmospheric lines are almost completely absent from the spectrum.

The successive appearance and disappearance, in a constant order, of various lines in an elementary spectrum is to be observed both when the same substance is subjected to electric discharges of varying intensity, and also when, under constant electrical conditions, the proportion of an element in the substance examined increases from zero to an amount giving all the lines characteristic of the element. Valuable conclusions may be drawn from the duration of the lines belonging to an element which forms but a very small proportion of the substance examined; the time of visibility appears to be a function of, if not proportional to, the amount of the element volatilised. The intermittent or irregular appearance of certain lines may afford indications of the structure of the substance, if this is a solid, or of the distribution of the elements therein. The presence of a small proportion of an element in a substance may be manifested by a spectrum which is (1) persistent, consisting of the principal lines, (2) transient, or (3) intermittent and irregular. It should be noted that the delicacy of spectral reactions varies with different elements. N. L.

Dissociation Spectra of Fused Salts. Alkali Metals: Sodium, Lithium, Potassium. By ARNAUD DE GRAMONT (*Bull. Soc. Chim.*, 1897, [iii], 17, 778—780, 780—782).—The lines characteristic of the metals sodium, potassium, and lithium were obtained by deducting from the complete spectrum of various dissociated salts the lines due to the non-metallic elements, and also by observation of the spectrum of the carbonates under special conditions.

Sodium.—6161 and 6155, strong and bright; 5896 and 5890, intense; 5688 and 5683, strong and bright; 5675 and 5670, feeble; 5155 and 5151, fairly strong; 4983 and 4979, very distinct, very diffuse, and nearly confused; *4572, feeble and diffuse; *4670, fairly distinct but diffuse; *4545, feeble and diffuse; *4499, fairly distinct but diffuse.

Owing to the condensation, the doublets marked with an asterisk appear as diffuse bands.

Lithium.—6708, strong and bright; 6103, very strong; 4972, strong; 4603, strong, large, and diffuse; 4273, very distinct; 4132, very distinct and very diffuse.

Potassium.—7699 and 7666, visible with difficulty; 6939, fairly strong; 6911, very well marked; 6308, well marked; 6245·5, very distinct; 6117·5, very well marked; 5832, strong; 5811, very fairly distinct; 5801, strong; 5783, very well marked; 5515, feeble; 5360, very distinct and diffuse; 5344, very fairly distinct and diffuse; 5340, very distinct and diffuse; 5323·5, very fairly distinct and diffuse; 5113 and 5099, very fairly distinct, diffuse, and nearly confused; 5051 and 5007, feeble; 4855·5 and 4851, very fairly distinct; 4829, fairly strong; 4652 and 4606, very fairly distinct; 4506·5 and 4466, feeble; 4388 and 4309·5, very fairly distinct; 4306·5, very fairly distinct; 4264, fairly strong; 4225·5 and 4222·5, very fairly distinct; 4210, feeble; 4185·5, fairly strong and broad; 4045·5, strong, very broad, and diffuse. N. L.

Spectra of Aluminium, Tellurium, and Selenium. By **Arnaud de Gramont** (*Compt. rend.*, 1898, 127, 866—868).—The lines at $\lambda = 6371 \cdot 3$, $6344 \cdot 8$, and $5056 \cdot 6$, observed by Thalèn in the spectrum of aluminium, are not visible when the metal employed has been carefully purified. The first two coincide in position with the very strong lines, 6369·7 and 6342·2, of the doublet Siα, observed by the author in the spark spectrum of silicon (Abstr., 1897, ii, 238; the line 6369·7 was, by a misprint in the original paper, given as 6969·7). The third line probably corresponds with the line 5060·0 of the strongly defined doublet Siγ, the second line of which was not recorded by Thalèn owing to its nearly coinciding with the line 5045·1 of the spectrum of air. The line 4445·2, observed in the spectrum of aluminium by Hartley and Adeney (*Phil. Trans.*, 1884, 101), is probably identical with the line 4445·8 of air.

The green lines, 5217, 5153, and 5105, in the spectrum of tellurium (Thalèn) are probably due to copper, as they are visible neither in spectra of tellurites or tellurates, nor in that of tellurium from which all traces of copper and antimony have been removed; Demarçay, also, has failed to observe their presence in the case of a solution of tellurium in hydrochloric or hydrofluoric acid. The same copper lines are present in Plücker and Hittorf's spectrum of selenium, and the author himself has previously noted their presence in the same spectrum (Abstr., 1895, ii, 338); he now finds, however, that in his own case they were due to the platinum he employed to furnish the spark being contaminated with copper. The lines cannot be observed in the spectra of pure selenates or selenites, although they are invariably present in the spectra of seleniferous minerals, notably in the case of clausthalite (PbSe). W. A. D.

Rotatory Dispersion of Tartaric Acid and Turpentine Oil. By **George V. Wendell** (*Ann. phys. Chem.*, 1898, [ii], 66, 1149—1161).—The rotation of tartaric acid solutions was measured for the Fraunhofer lines *C*, *D*, *E*, *b*, and *F*. With increasing concentration, the maximum is displaced towards the red end of the spectrum, so that with a 50 per cent. solution it is found in the green. The specific rotation decreases with increasing concentration, but the rate of decrease is very different in different parts of the spectrum, being lowest in the red; on the other hand, the specific rotation increases rapidly with rising temperature, the rate of increase being greater for the concentrated than for the dilute solutions. The effect of rising temperature is to displace the maximum rotation towards the violet end of the spectrum.

Measurements with dextro- and lævo-turpentine oil show a perfect regularity in the behaviour of these substances, as the rotation increases with the refrangibility of the rays used. Mixtures of the two oils were also examined, and it was found that the observed rotations differ slightly, but quite definitely, from those calculated with Biot's formula for mixtures of optically active compounds. H. C.

Thermochemical Theory of the Carbon Cell. By **Donato Tommasi** (*Bull. Soc. Chim.*, 1897, [iii], 17, 963—964).—The author has previously described an electric element in which the electrodes are of carbon, one being coated with lead peroxide, and immersed in a solution of sodium chloride (Abstr., 1887, 756), and he regarded the action as due to the oxidation of the uncoated carbon and the reduction of the peroxide. Reed (*Electrical Review*, 1896) considered the current to be due to the action of the sodium chloride on the lead peroxide, but this view is untenable, as in that case the coated carbon should be the negative electrode, whereas the reverse obtains. Further, the E.M.F., calculated according to the author's view of the action, is equal to that actually found for the element. L. M. J.

Dissolving of Platinum and Gold in Electrolytes. By MAX MARGUELES (*Ann. Phys. Chem.*, 1898, [ii], **66**, 540—543).—The author makes some additions to his former statements (Abstr., 1898, ii, 497) with reference to the dissolving of platinum and gold in electrolytes. The dissolution of platinum takes place only at the anode when the cation of the electrolyte is hydrogen; in salt solutions, the platinum is attacked simultaneously at both anode and cathode. Platinum not only dissolves in the electrolytes previously named, but also in phosphoric, formic, and acetic acids; oxalic acid is, however, without effect. H. C.

Ammonium Amalgam. By POCKLINGTON (*Chem. Centr.*, 1898, ii, 853; from *Elektrician*, **41**, 457).—In order to prepare ammonium amalgam and to measure the E.M.F. between a mixture of the amalgam with mercury and a strip of copper immersed in copper sulphate solution, the author uses a cell containing mercury and divided into two portions by a partition which dips into the mercury, but does not reach to the bottom of the cell. The ammonium amalgam, prepared by electrolysing a solution of ammonium chloride in one half of the cell, quickly diffuses into the mercury in the other half, and here the E.M.F. between the mixture and a copper electrode in a solution of copper sulphate is tested. Whilst, before the passage of the current, the E.M.F. is only 0·16 volt, after it has passed for a few seconds it rises to 1·89 volts, but when the circuit is broken it falls quickly. Even when the froth formed on the surface of the mercury is brushed off, the E.M.F. still remains high. When dilute sulphuric or hydrochloric acid is used instead of ammonium chloride, the E.M.F. is only 0·1 volt, and with a solution of sodium chloride the E.M.F. only attains 0·62 volts in 12½ minutes owing to the slow diffusion of the amalgam, for when crystals of the amalgam are transferred to the other portion of the cell, the E.M.F. rises to 2·146 volts. Potassium amalgam diffuses even more slowly than sodium amalgam. When ammonium amalgam is heated, its volume increases by an amount greater than that due to the expansion of the contained gases. The author concludes that an ammonium amalgam is first formed and then decomposes into mercury, hydrogen, and ammonia. E. W. W.

Electrical Dispersion of some Organic Acids, Ethereal Salts, and Ten Varieties of Glass. By K. FRIEDRICH LÖWE (*Ann. Phys. Chem.*, 1898, [ii], **66**, 390—410).—The ethereal salts of the fatty acids and of benzoic acid do not show any abnormal electrical absorption or dispersion (compare Drude, Abstr., 1897, ii, 303); this is also the case with ethylic cyanacetate, benzoylacetate, and acetoneoxalate, and some other ethereal salts examined by the author. Isopropylic alcohol and the butylic alcohols show an abnormal behaviour, and this is also probably the case with lactic acid. Ten different kinds of glass were examined, but the results are not sufficiently definite to decide whether the dispersion is normal or abnormal. H. C.

Velocities of the Electrical Ions in Dilute Aqueous Solutions of up to One-tenth Normal Concentration at 18°. By Friedrich Kohlrausch (*Ann. Phys. Chem.*, 1898, [ii], **66**, 785—825).—For solutions of one-twentieth to one-tenth of the normal concentration, the conductivities of compounds composed of univalent ions, or of univalent ions in union with bivalent ions, may be calculated from the ionic velocities, which, in this case, depend for each univalent ion on concentration only. This does not hold for compounds composed of the bivalent ions only; for these last componnds, the velocities vary in each case with increasing concentration in the same regular manner from the velocities in solutions of infinite dilution, so that if l is the velocity in a solution of concentration n, and l_∞ the velocity at infinite dilution, $l = l_\infty - Qn^{\frac{1}{3}}$, where Q is a constant for all ions. If the conductivity is given in $\text{cm.}^{-1}\ \text{Ohm}^{-1}$ and the concentrations in gram-equivalents per litre, Q has the value 213. This does not hold for the hydroxyl ions of the bases or the hydrogen ions of the acids, as the decrease in velocity with rising concentration is far more marked in these cases. The fall in the velocities of the bivalent ions is also not quite the same when these ions are in union with univalent ions, as when in union with other bivalent ions. All ions in solutions of infinite dilution have velocities entirely independent of the other ions with which they are associated.

H. C.

Conductivity Method of Studying Moderately Dilute Aqueous Solutions of Double Salts. By James G. MacGregor and E. H. Archibald (*Phil. Mag.*, 1898, [v], **46**, 509—519. Compare Abstr., 1898, ii, 366).—In the cases which the authors have investigated so far, the conductivity of solutions containing two electrolytes with a common ion is calculable by means of the dissociation theory up to a concentration of about 1 gram-equivalent per litre. The conductivity of solutions of the double sulphate of potassium and copper is similarly calculable only up to a concentration of about 0·1, and has at concentration 1 a considerably smaller value than that calculated on the assumption that no double molecules are present. The solutions of double salts have, at concentration unity, an appreciably smaller conductivity than the equivalent mixtures. The conductivities of mixtures, in molecular proportion, of solutions of zinc and copper sulphates, and of potassium and sodium sulphates are calculable within the limits of observational error up to a concentration, unity; and, therefore, the non-calculability in the case of the double salt solutions is probably not due to defective data. The differences between the observed and calculated values of the conductivity of the double salt solutions and of the equivalent mixtures, and between the observed values in these two sets of solutions, are such as would be accounted for by the presence of double molecules in both, and their presence in slightly greater number in the double salt solutions than in the equivalent mixtures. H. C.

Molecular Elevation in the Boiling Point of Liquid Ammonia. By EDWARD C. FRANKLIN and C. A. KRAUS (*Amer. Chem. J.*, 1898, **20**, 836—853).—The molecular elevation in the boiling point of liquid ammonia caused by dissolved substances was determined by a modified form of Beckmann's apparatus; the solvent was boiled in a small vacuum-jacketed Dewar-tube by the heat generated by passing an electric current through a platinum spiral immersed in the liquid ammonia. The vapour of the boiling solvent was not condensed, as is the case in the usual method, but was allowed to escape; the amount of solvent present after each boiling point measurement being determined by weighing the whole apparatus and its contents. It was found necessary to introduce a correction for the fall observed in the boiling point of the solvent, as the latter boiled away; details are given in the original paper. The constant of molecular elevation of the boiling point was calculated from the formula

$$\frac{\text{Grams solvent} \times \text{elevation} \times \text{mol. wt.}}{\text{Grams solute} \times 100} = \text{“constant.”}$$

For dilute solutions of water, ethylic alcohol, propylic alcohol, phenol, catechol, resorcinol, quinol, cane-sugar, carbamide, pyridine, aniline, orthonitrophenol, and benzene, the values lay between 3 and 3·5; in more concentrated solutions, most of these substances gave lower values; cane sugar, however, gave higher values. Acetic acid interacts violently with liquid ammonia; the molecular elevation, calculated for acetic acid, has a value 2·0 for moderately concentrated solutions, and decreases with increasing concentration.

Although solutions of sodium nitrate, ammonium nitrate, and potassium iodide in liquid ammonia conduct electricity well, the values of the molecular elevations in the case of the dilute solutions are comparatively low; in each solution, however, a rapid increase of the constant occurs with increasing concentration, probably owing to the formation of a compound of ammonia with the salt. In the case of sodium and lithium, very low values are obtained for the molecular elevation; they vary from 1·50 for the more concentrated solutions to about 2·30 for the more dilute, and probably indicate the presence in solution of a molecule containing two atoms of the metal (compare Joannis, Abstr., 1893, ii, 115). W. A. D.

Aqueous Soap Solutions. By LOUIS KAHLENBERG and OSWALD SCHREINER (*Zeit. physikal. Chem.*, 1898, **27**, 552—566).—It has been shown by Krafft that soaps cause no elevation of the boiling point, so that the apparent molecular weight becomes infinite; he, therefore, regards them as colloids and has developed a theory regarding colloidal solutions (Abstr., 1896, i, 80; ii, 468). The authors consider, however, that the apparent boiling point of the soap solution is not the true value, as the development of steam is extremely limited and little or no water can be distilled over. The ‘pseudoboiling’ is hence due to the formation of soap bubbles and dependent on the high surface tension, and with an increase of the heat supply the temperature rises with increased frothing. The gelatinisation of the liquid on cooling does not suffice to establish the colloidal nature of soap, and experiments on the conductivity show that the solutions, unlike those of colloids, are conductors; the increase of conductivity with dilution is more rapid than that calculated by the dilution law, and indicates a probable decomposition into acid salt and free alkali. Cryoscopic observations with sodium oleate gave a molecular weight = 512—560, and hence indicate the presence of double molecules; for other soaps, the method is not available owing to the precipitation of the salt, and experiments on the diminution of vapour pressure led to no definite results. L. M. J.

Exact Cryometry; Application to Aqueous Solutions. By François M. Raoult (*Zeit. physikal. Chem.*, 1898, **27**, 617—661).—The question of the accuracy attainable in cryoscopic observations is fully discussed, the effects of barometric pressure and variation of the zero point are considered, and the probable errors estimated. With thermometers graduated to 0·01°, readings can be taken to 0·0001° by a telescope with micrometer eye-piece. The cold bath consists of a vessel of ether, which by a current of air may be brought to and kept at any desired temperature, and the tube containing the liquid under observation is provided with a rotatory stirrer surrounding the thermometer. The freezing point of water is taken both before and after that of the liquid, in order to eliminate errors due to barometric changes. The freezing point is taken by first overcooling the liquid to the extent of about 1°, and then inducing crystallisation by the addition of a small quantity of ice contained in a capillary tube. From the extent of overcooling, the quantity of ice formed may be calculated, and hence the correction necessary owing to the change of concentration. The external bath is so regulated that the convergence temperature is as near the actual freezing point as possible, and the author finds that the former is almost entirely independent of the atmospheric temperature but is considerably affected by variations in the rate of stirring; this is, therefore, kept constant during all the experiments. Dissolved air also influences the freezing point, and it was found that 1 c.c. of oxygen in 100 grams of water causes a depression of *about* 0·0009°, which indicates that oxygen, and hence, probably, nitrogen also, produces a normal depression. When all disturbing effects are eliminated and corrections applied, the author considers an accuracy of 0·001° to be readily obtainable, and that with great care an accuracy of 0·0002° may be expected. Cane sugar produces a molecular depression of 20·79 at the concentration 34·5 grams sugar to 100 grams water, and 18·7 at low concentrations; the several values lie almost accurately on a straight line, no indication being obtained of the marked decrease of molecular depression at high dilutions which has been observed by other investigators. Alcohol gave a molecular depression varying from 18·34 to 18·26, and for depressions above 0·2° the results are almost identical with those of other observers; here, however, no indication was obtained of a lower value at very dilute solutions, although this was observed by Loomis and Wildemann. The molecular depression of alcohol at infinitely dilute solutions (18·3) is hence somewhat lower than that of cane sugar (18·7). The values obtained for sodium and potassium chlorides are also almost identical with previous values except those of Ponsot, and the author considers the method adopted by Ponsot is incapable of yielding accurate values (compare Abstr., 1894, ii, 342; 1897, ii, 88). L. M. J.

Thermochemical Researches on Chlorinated Derivatives of the Acetic Benzoic and Salicylic Series. By PAUL RIVALS (*Ann. Chim. Phys.*, 1897, [vii], 12, 501—574).—This is a *résumé* of thermochemical determinations which have already appeared (compare Abstr., 1895, ii, 254, 306, 483; 1896, ii, 409, 410, 588; 1897, i, 413, ii, 359; 1898, ii, 106). G. T. M.

Thermal Study of Normal Propylmalonic Acid. Heat of Formation of the Solid Potassium Salt. By GUSTAVE MASSOL (*Compt. rend.*, 1898, **127**, 1223—1224).—Anhydrous normal propylmalonic acid dissolves in water (146 grams in 2 litres) with development of heat (+3·16 Cal.).

Determinations of the heat of neutralisation of the acid with potash gave the following results.

$C_6H_{10}O_4$ diss. $+$KOH diss. $= C_6H_9O_4K$ diss. .... $+13·92$ Cal.
$C_6H_9O_4K$ „ $+$KOH „ $= C_6H_8O_4K_2$ „ .... $+13·86$ „
$C_6H_{10}O_4$ „ $+$2KOH „ $= C_6H_8O_4K_2$ „ .... $+27·78$ „

The normal potassium salt is very deliquescent, is dried only with much difficulty, and at 135° still retains $1H_2O$; the desiccation is only complete after the salt has been kept for several days in dry hydrogen at 150—160°.

The anhydrous salt dissolves in water (1 gram-mol. in 8 litres) and develops $+$ 6·06 Cal., hence

$C_6H_{10}O_4$ sol. $+$2KOH sol. $= C_6H_8O_4K_2$ sol. $+ 2H_2O$ ...... $+46·34$ Cal.

This number is very close to that given by the homologous compound isoamylmalonic acid (+46·69), but is less than that of the lower homologue, ethylmalonic acid (+48·25). A. L.

Osmotic Researches with Dilute Solutions of Cane Sugar. By A. PONSOT (*Compt. rend.*, 1898, **125**, 867).—The osmotic pressure was determined in the case of solutions of cane sugar containing 1·235 grams per litre, the method employed being the direct observation of the head of water necessary to maintain equilibrium between water and the solution separated by a semipermeable partition. With different vessels, the values obtained were 870, 873, 869, 873, and 867 mm., whilst the pressure due to a perfect gas at the same concentration is 870 mm. It hence follows that, in very dilute solutions of cane sugar, neither dissociation nor association occurs. L. M. J.

Osmosis of Liquids across a Membrane of Vulcanised Caoutchouc. By G. FLUSIN (*Compt. rend.*, 1898, **126**, 1497—1500). —Raoult has shown that across vulcanised caoutchouc osmosis between ether and methylic alcohol takes place in the opposite sense to that across animal membranes, and the author has extended Raoult's observations. Osmotic phenomena are not observable with water, alcohol, and acetic acid, but are marked with many organic liquids. The velocities with which the liquids examined passed across the membrane into ethylic alcohol were determined by the aid of Raoult's osmometer, and gave the following descending order: carbon bisulphide, chloroform, toluene, ethylic ether, benzene, xylene, petroleum, $(D_0 = 0{\cdot}720)$, benzylic chloride, oil of turpentine, petroleum, $(D_0 = 0{\cdot}812)$, nitrobenzene. The osmotic current between any two of these liquids was found to be in the sense indicated by their positions on the list, from chloroform to benzene, &c., but the velocity could not be deduced from their velocities relatively to alcohol. All these liquids are absorbed by caoutchouc, and the quantity absorbed in various times was determined, and showed that the velocities found above were approximately proportional, not to the total quantity absorbed, but to that absorbed during a short initial time of immersion (compare Abstr., 1895, ii, 487).

L. M. J.

Zones of Reaction. By Albert Colson (*Compt. rend.*, 1898, **126**, 1505—1508).—If the state of a dissociable system, such as chalk, be represented by temperature and volume coordinates, then a diagram detailed below may be obtained. If the pressure is above the dissociation pressure, there is a line *ABCD* almost parallel to the temperature axis, but if the gas is withdrawn at its dissociation pressure, then at the temperature of *B* the volume increases along *BM* parallel to the volume axis. The length of *BM* decreases with rise of temperature, so that the end *M* lies on a curve *LMN* which approaches *ABCD* and may be considered to meet it at a sufficiently high temperature which the author terms a chemical critical temperature and which is the analogue of the ordinary critical temperature. Hence the space is divided into a number of zones by the lines *ABCD*, *BM*, and *LMN*, namely, an 'equilibrium zone,' between these lines, a 'zone of complete decomposition' outside *LMN*, and a 'zone of complete restitution' below *BM*. If, however, in the dissociated system the temperature is rapidly lowered sufficiently, the products do not again combine, so that the lower portion of the restitution zone becomes a passivity zone, and this passive zone probably occurs in many reactions, so that it is necessary for the system to attain a certain 'reaction point' before any change can occur.

L. M. J.

Reaction Between Silver Acetate and Sodium Formate. A Reaction of the Third Order. By Arthur A. Noyes and George J. Cottle (*Zeit. physikal. Chem.*, 1898, **27**, 579—585).—The reaction may be represented by the equation $2AgC_2H_3O_2 + HCO_2Na = 2Ag + CO_2 + HC_2H_3O_2 + NaC_2H_3O_2$, or $2Ag' + HCO'_2 = 2Ag + CO_2 + H'$; from this, it appears to be a trimolecular equation, and determinations of the reaction velocity showed that in a series of experiments with different initial concentrations the values of C_3 were far more constant than those of C_2 and remained more constant during the course of each experiment. The reaction must hence be considered to be of the third order.

L. M. J.

Equilibrium in Precipitates. By Friedrich W. Küster (*Zeit. anorg. Chem.*, 1898, **19**, 81—96).—If a small quantity of silver nitrate is added to a solution containing chloride and bromide of potassium, the precipitate contains both silver bromide and silver chloride, and the author investigated the relation between the composition of the solution and that of the precipitate. Preliminary experiments showed that the composition of the precipitate changes after precipitation, and the final composition is the same as that produced when the silver nitrate is added to one of the halogen salts and the second haloid added after precipitation. Equilibrium is hence ultimately attained between the precipitate and solution. In all the experiments, 100 c.c. of N/10 silver nitrate was added to a litre of solution containing from 0·1 to 400 millimolecules of potassium bromide and from 1010 to 610 millimolecules of potassium chloride, so that the final liquid was always normal with respect to the halogens The ratio AgBr/AgCl in the precipitate was found to increase from 0·0065 to 308·5 and the ratio KBr/KCl in the solution increased from 0·000036 to 0·6395, so that the ratio of bromide to chloride is not the same in precipitate and solution, neither are the two values in a constant ratio. The value (AgBr in precipitate)/(KBr in solution), however, is approximately constant as long as the concentration of the potassium bromide does not exceed about 10 millimolecules per litre. As in dilute solution the ratio of undissociated silver bromide to potassium bromide must be approximately constant, it follows that the concentration of the silver bromide in the precipitate bears a constant ratio to that in the solution, that is, the partition ratio is constant, from which it follows that the molecular complexity is the same in the two states. The author considers that the two salts are present in the precipitate in the form of an isomorphous mixture. L. M. J.

Velocity of crystallisation. By A. Bogojawlensky (*Zeit. physikal. Chem.*, 1898, **27**, 585—600).—The crystallisation velocity for various degrees of undercooling was determined for a large number of compounds. The effect of repeated crystallisation was investigated in the case of benzil, and it was found that, after the third recrystallisation from alcohol, further purification had but little effect. Addition of sulphonal or of benzophenone produced a lowering of velocity, which the author states is greater for small than for great undercooling; the numbers and curves, however, hardly warrant any general statement. Benzil, sulphonal, picric acid, mannitol, santonin, erythritol, and antipyrine gave curves completely analogous to those found by Tammann and Friedländer for benzophenone, consisting of (1) an ascending portion in which the velocity increases with the undercooling; (2) a horizontal portion in which the velocity is constant, and (3) a portion where the velocity rapidly decreases. The extent of undercooling at which a constant velocity is reached varied from about 20° to 60°. With menthol, dinitrophenol, benzoin, and coumarin, the constant value was not attained, whilst for some compounds the velocity never is constant, but reaches a maximum and then decreases. This was the case with cotoin, salipyrine, trichlorolactic acid and peucedanin (Abstr., 1897, ii, 444; 1898, ii, 425). L. M. J.

The Taste of Salts. By Rudolf Höber and Friedrich Kiesow (*Zeit. physikal. Chem.*, 1898, **27**, 601—616).—The authors estimated the concentrations at which a salt taste is first observable in solutions of sulphate and chloride of potassium, sulphate, chloride, bromide, and iodide of sodium, and magnesium chloride. The concentrations of anion, cation, and undissociated molecule were then calculated at the found concentrations of the salt. In all the above cases, the anion concentration remained approximately constant, so that the salt taste is due to the anion. Analogous results were obtained with salts of ammonia and amines, but no saline taste was found with magnesium sulphate, it being completely hidden by the bitter taste. Solutions of beryllium sulphate and chloride have a sweet taste at equal cation concentrations, so that the actual taste appears to be due to both ions and possibly also in part to the undissociated molecule. For a number of hydroxyl compounds, it was found that a sweet taste was first observable when the concentration of the OH ions reached about 0·006—0·009 gram per litre.

L. M. J.

Recalculation of Atomic Weights by the Method of Limiting Density. By DANIEL BERTHELOT (*Compt. rend.*, 1898, **126**, 1501—1504).—The author has previously pointed out that the molecular weights of gases are proportional to their densities at infinitely small pressure, and that these may be calculated from compressibility data. The atomic weights of hydrogen, nitrogen, and carbon had been thus calculated from the limiting density of their oxides, and the results are in accord with the best chemical determinations (Abstr., 1898, ii, 502). Further calculations are given, the compound the density of which is employed being added in brackets: Carbon (acetylene), 12·0025; (carbonic anhydride), 12·000; (carbon monoxide), 12·007, probable value, 12·005. Nitrogen (nitrous oxide), 14·000, probable value, 14·005. Argon (from Rayleigh's determinations), mol. wt. = 39·882. Chlorine (hydrogen chloride), 35·479, identical with that obtained from Stas' analysis of silver chlorate if the value Ag = 107·912 is accepted. Sulphur (sulphurous anhydride), 32·046; that resulting from Stas' analysis of silver sulphate is 32·045 if Ag = 107·912. The physical method hence appears, where applicable, to be capable of great accuracy, and the author's method of calculation is fully justified. L. M. J.

Inorganic Chemistry.

Structural Isomerism in Inorganic Compounds. By ARTHUR HANTZSCH (*Zeit. anorg. Chem.*, 1898, **19**, 106—108).—Sabanéeff has proved the existence of certain isomeric ammonium and hydrazine salts (Abstr., 1898, ii, 577) and the author points out that his statement that structural isomerism is absent among inorganic compounds does not apply to such cases, many similar isomeric compounds having been found by Werner and others. The isomerism in all these is due to the union of different distinct groups, not to different arrangements in one group. His statement is more definite if the words 'inorganic compound' be replaced by "inorganic non-electrolyte or ion." L. M. J.

Specific Gravity of Liquid Air and of other Liquefied Gases. By ALBERT LADENBURG and C. KRÜGEL (*Ber.*, 1899, **32**, 46—49. Compare Cailletet and Matthias [Abstr., 1886, 758], Wroblewski [Abstr., 1884, 14, 388; 1886, 661], Olszewski [Abstr., 1884, 816; 1887, 694]).—Glass rods, the sp. gr. of which were previously determined by weighing in air and in water at 4°, were carefully weighed in liquid air and the decrease in weight noted, a Mohr's balance being employed. Corrections to weight in a vacuum were not made, neither were corrections for the expansion of glass introduced, as the coefficient of expansion at low temperatures is not known. In addition to taking the sp. gr., the authors have also determined the composition of the liquid air, and the following results have been obtained.

1. Freshly liquefied air, sp. gr. 0·9951; per cent. of oxygen, 58·83.

2. After remaining for several hours, sp. gr. 1·029; per cent. of oxygen, 64·2.

3. After standing for 2—3 days, until most of the nitrogen had evaporated, sp. gr. 1·112; per cent. of oxygen, 93·6.

Using these data, the authors have calculated the sp. gr. of a liquid air containing 20·9 per cent. of oxygen, and find it to be 0·87—0·90.

Liquid oxygen itself has a slightly lower sp. gr., namely, 1·105—1·108, than the mixture (3) containing 93·6 per cent. of oxygen.

The melting point of ethylene has been found to be $-169°$, and the boiling point $-105·4°$ at 760 mm. pressure; Olszewski gives the same melting point, but $-102·5°$ as the boiling point. The sp. gr. $=0·6585$ at $-169°$, and $=0·571$ at $-105·4°$. J. J. S.

Liquid Ammonia as a Solvent. By EDWARD C. FRANKLIN and C. A. KRAUS (*Amer. Chem. J.*, 1898, **20**, 820—836. Compare Gore, *Proc. Roy. Soc.*, 1873, **21**, 140).—The author has determined the solubility in commercial liquid ammonia of 175 metallic salts and 250 carbon compounds; his results may be summarised as follows. The alkali metals, lithium, sodium, potassium, rubidium, and cæsium, are easily soluble in liquid ammonia, as well as the elements iodine, sulphur, phosphorus, and selenium; copper is slowly acted on by the solvent, especially in presence of air. Metallic fluorides appear to be mostly insoluble, and the same is true of the chlorides of the alkali metals; several of the chlorides of the heavy metals, however, are readily soluble, whilst the chlorides of magnesium, calcium, strontium, barium, zinc, cadmium, manganese, cobalt, nickel, and lead are acted on by liquid ammonia with considerable development of heat, to form insoluble additive products. Metallic bromides are more soluble than the corresponding chlorides, whilst the iodides are mostly very easily soluble; the iodides of magnesium, zinc, and cadmium, like the corresponding chlorides, appear to combine with liquid ammonia to form additive products, although these are much more soluble than those obtained in the case of the chlorides. Sulphates, sulphites, carbonates, oxides, hydroxides, phosphates, oxalates, arsenates, ferrocyanides, and ferricyanides are insoluble in liquid ammonia, and the same is true of the sulphides with the exception of ammonium and arsenious sulphide; cyanides, cyanates, thiocyanates, and nitrates are, as a rule, easily soluble.

Although the paraffins do not dissolve in liquid ammonia, their halogen derivatives are, as a rule, readily soluble, but the solubility diminishes as the complexity of the hydrocarbon radicle is increased. Although the lower alcohols are miscible with liquid ammonia, cetylic alcohol is insoluble; diethylic ether is easily soluble, but diamylic ether dissolves only sparingly. Ethylenic glycol and glycerol are miscible with ammonia, whilst erythritol, dulcitol, and mannitol are only slightly soluble. The simpler aldehydes and their derivatives, the lower fatty acids and their halogen- and hydroxy-substituted products, and the ethereal salts are easily soluble, although the solubility decreases in each series with increasing molecular weight. Dibasic acids, and their hydroxy-derivatives, are very sparingly soluble, whilst the sugars, nitriles, cyanates, thiocyanates, amines, amido-acids, acid amides, and ureides are generally readily soluble.

Aromatic hydrocarbons and their halogen derivatives, are, as a rule, only slightly soluble in liquid ammonia, although benzene is dissolved to the extent of 10 per cent.; the nitro-derivatives of the hydrocarbons are moderately soluble, whilst most amido-derivatives dissolve very readily, although the secondary and tertiary aromatic amines are only slightly soluble. The phenols and their ethers, together with their substituted derivatives, the aromatic alcohols, aldehydes, acids, substituted acids, sulphonic acids, ethereal salts, and acid amides and anilides, are all easily soluble. The dibasic acids are, however, insoluble, and the same is true of derivatives of the terpenes; naphthalene and isoquinoline are slightly soluble, whilst the naphthols, naphthylamines, pyridine and quinoline are easily soluble.

Benzene, metaxylene, triphenylmethane, naphthalene, chloro- and iodo-benzene, dibromobenzene, and parahydroxybenzoic acid, which are all very slightly soluble in liquid ammonia at – 38°, are easily soluble at 25°. Anthracene, pinene, stearic acid, cadmium iodide, and potassium chromate are, however, insoluble, whilst phthalic and succinic acids are disintegrated at 25° and their ammonium salts formed, although these remain undissolved. W. A. D.

Solubility of Salts. III. The Solubility of some Metallic Nitrates. By Robert Funk (*Ber.*, 1899, **32**, 96—106).—The various hydrates formed, their melting points, and the range of temperature over which each has been examined, are shown in the following table.

Cadmium nitrate, unlike the others which have been examined, crystallises at the ordinary temperature with $4H_2O$; the curve for the hydrate with $9H_2O$ extends from – 13° to + 1°, whilst that for the hydrate with $4H_2O$ extends from 0° to the melting point at 59·5°. The cryohydrate is formed at – 16°. The curve of solubility for the hydrate of magnesium nitrate with $6H_2O$ shows a well marked point of inflexion at 90°; a comparison of the temperature of formation and

Nitrate.	Cryo-hydrate.	$9H_2O$.	$6H_2O$.	$3H_2O$.
Magnesium.........	−29°	−23° to −18°	−18° to +67° m. p. 40°	
Zinc..................	−29°	−25° to −18°	−18° to +33·5° m. p. +36·4	+37° to +45·5° m. p. 45·5°
Manganese	−36°		−29° to +25·5° m. p. +25·8	27° to 35·5° m. p. 35·5°
Ferric	−28°	−27° to −15·5°	−9° to +60·5° m. p. 60·5°	
Cobalt...............	−29°	−26° to −20·5°	−21 to +56° m. p. 56°	+55° to 91° m. p. 91°
Nickel...............	−27°	−23° to −10·5°	−21° to +56·7° m. p. 56·7°	+58° to 95° m. p. 95°
Copper	−24°	−23° to −20°	−21° to +26·4° m. p. 26·4	+25° to 114·5° m. p. 114·5°

composition of the cryohydrates shows that the amount of water contained in the "cryohydrate" varies directly with the temperature at which the latter is formed. A. H.

Relations among the Hydrates of the Metallic Nitrates. By J. H. Kastle (*Amer. Chem. J.*, 1898, **20**, 814—819).—It is pointed out that most of the hydrates of the metallic nitrates contain either 3, 4, 6, 9, or 12 H_2O, and that in by far the greater number of these salts the number of molecules of water is some simple multiple of three. Assuming Armstrong's view (Proc., 1891, 118) that, in the formation of salts, a direct addition of the acid to the base first occurs, and that subsequently an intramolecular rearrangement takes place, often accompanied by a separation of water, the author suggests that the hydrates of the nitrates are formed by a direct combination of acid and base, without the aforesaid separation of water taking place. As examples of this type of action are adduced the hydrates, $CaSO_4 + 2H_2O$, $BaCl_2 + 2H_2O$, and $HgNO_3 + H_2O$, whose composition corresponds exactly with the sum of the acid and the base entering into action. In extending this view, the hydrates of the metallic nitrates are divided into several classes, according as they are considered to be derived from one or other of the hypothetical nitric acids, N_2O_5, HNO_3, H_3NO_4, H_5NO_5, &c. The anhydrous nitrates, by this hypothesis, are looked on as the additive products of the action of nitric anhydride and metallic oxides. W. A. D.

Metallic Phosphides and Arsenides. By ALBERT GRANGER (*Chem. Centr.*, 1898, ii, 1004; from *Arch. Sci. phys. nat. Genève*, [iv], **6**, 391—393. See Abstr., 1898, ii, 474).—By the action of arsenic trichloride on metals, arsenides are prepared analogous to the phosphides obtained by the action of phosphorus trichloride on the same metals.
E. W. W.

Silicon and Metallic Silicides. By ÉMILE VIGOUROUX (*Ann. Chim. Phys.*, 1897, [vii], **12**, 5—74 and 153—196).—These papers contain an historical introduction, and a detailed account of the author's contributions to the chemistry of amorphous and crystalline silicon and metallic silicides which have been previously published (compare Abstr., 1895, ii, 222, 263, 264, 447; 1896, ii, 176, 249, 362, 600).
G. T. M.

The Newly Discovered Gases, and their Relation to the Periodic Law. By WILLIAM RAMSAY (*Ber.*, 1898, **31**, 3111—3121).—A lecture delivered before the German Chemical Society on Dec. 19th, 1898.—It is possible that a group of elements may exist between the N, P, &c., and Li, Na, &c., groups of the periodic system; these would be He = 4, ? = 20, A = 40, &c. In the hope of obtaining the second member of this group, 15 litres of argon was examined, with a view to ascertain whether some lighter gas is not contained in it. The argon was obtained by working up a large quantity of air in the usual way; the apparatus was on a large scale, however, iron tubes of 5 cm. diameter and gasometers of 200 litres capacity being employed; the smaller gasometers, employed to hold the gas when it had become rich in argon, were constructed so that the cylindrical upper part rose and fell in a narrow, ring-shaped trough filled with water, in order to diminish the volume of water with which the argon came in contact, and the consequent loss of the gas by dissolution. The air was first passed over heated copper to remove oxygen; then twice in succession over heated magnesium to remove nitrogen, followed by heated copper oxide to remove hydrogen that had been formed; finally, in order to remove the remaining nitrogen, the gas was passed backwards and forwards over a red-hot mixture of lime and magnesia, followed by copper oxide and drying tubes. The argon was then introduced into a Dewar's tube cooled with liquid air boiling under a pressure of 10—15 mm., and there liquefied; about 25 c.c. of a clear liquid was obtained, with some solid flakes floating in it. The pressure on the boiling air was then allowed to rise, when the argon boiled off; the first small fraction was collected in a mercury gasometer; the bulk was returned to the larger gasometer, and the small, least volatile part, which volatilised but slowly from the solid residue, was collected apart. The last substance is named *metargon*; it has been but little examined as yet, nor has it been freed from argon; it exhibits the "Swan-spectrum," namely, that of carbonic oxide, when mixed with oxygen and sparked over caustic potash. The first, most volatile, fraction was again cooled with liquid air; a portion would not liquefy, and this was found to contain a new gas, *neon*, with a density of about 9·65, mixed with helium and argon. In order to separate these, enough oxygen was added to make four-fifths of the mixture liquefy when cooled with boiling liquid air; the unliquefied part, rich in helium, was collected apart; so also the last fraction containing neon and argon, whilst the middle fraction, after removal of the oxygen by red hot copper, was moderately pure neon, still containing some helium and argon, however. It had a density = 10·04, or after sparking with oxygen in presence of caustic potash, 10·19; its refractive power as compared with air was 0·338, and its spectrum exhibited the following lines, amongst others—red, 6402, 6383, 6335, 6227, 6218, 6164, 6143, 6096, 6074, 6030; yellow (D_5), 5853; green, 5401, 5341, 5331; blue, 4716, 4722, 4710, 4709, 4704. Assuming that neon has 1·67 as the ratio of its specific heats, it is an element, and its atomic weight, as indicated by the density 10, will be 20, so that it is, in fact, the element sought for belonging to the periodic group mentioned above.

The middle fraction obtained in the original fractional distillation of the liquid argon was fractionated twice more in the same way, the middle and by far the largest, fraction being collected each time; finally, this fraction was liquefied, boiled, and collected in 6 fractions, the density and refractivity of which were severally measured; these were the same in the case of all the fractions except the first; their values, density = 19·96 and refractive power = 0·968, may be regarded as the true values for pure argon.

The last portion that boiled off from the liquid air used for liquefying the argon was collected separately; after removal of the oxygen, the residue was not pure argon, for it was found to have the density 22·50, it had 1·66 as the ratio of its specific heats, and exhibited three brilliant lines in the red, yellow, and green (5570) respectively. The new element, the presence of which was thus indicated, was named *kyrpton*. A third gas, accompanying argon in air, has also been obtained in an impure state, when its density was 32·5 (an element with density of 40·5—41·5, and atomic weight 81—83, would occupy a place in the helium group, coming between bromine and rubidium in the periodic series). This gas is named *xenon*; it is present in so small amount in air that it could not be detected in the 15 litres of argon, but only in the large quantity of liquid air used; its spectrum exhibits many lines, but none of these are brilliant.

In order to see if any compound of argon with magnesium had been formed during the isolation of the argon from air, 700 c.c. of the magnesium nitride was treated with water in an exhausted flask, the ammonia evolved being absorbed in acid; of other gases, only 50 c.c. was obtained, consisting mainly of hydrogen with a little nitrogen and a trace of hydrocarbon and argon. The magnesia formed was extracted with water, the solution evaporated, and the residue treated with sulphuric acid in an exhausted flask; the gas evolved consisted entirely of carbonic anhydride. C. F. B.

Electrolysis of the Alkali Chlorides. By F. WINTELER (*Zeit. Elektrochem.*, 1898, 5, 10—15 and 49—51).—The behaviour of different kinds of carbon when employed as anodes in the electrolysis of solutions of alkali chlorides is discussed. The formation of oxygen at the carbon anode and consequent production of carbonic anhydride is regarded as due to the decomposition of water by the chlorine condensed in the pores of the carbon. The greater the amount of hydrochloric acid present in the electrolyte, the less oxygen is evolved. Numerous experiments are described in which a solution of potassium chloride is electrolysed with a carbon anode, an iron cathode, and a porous porcelain diaphragm. The anodic liquid is always found to contain free hydrochloric acid, but neither hypochlorous nor chloric acid. The chlorine evolved contains about 5 per cent. of impurity, mainly oxygen and carbonic anhydride, with a trace of carbonic oxide. If it is attempted to increase the concentration of the caustic potash formed in the cathode compartment beyond about 8 per cent., the current efficiency falls below 70 per cent. By using a double diaphragm, a higher concentration of the caustic alkali may be attained, together with good current efficiency, but at the cost of a higher E.M.F.

A number of samples of commercial electrolytic potassium chlorate were examined for perchlorate with negative results. T. E.

Electrolysis of Alkali Chlorides. By H. Wohlwill (*Zeit. Elektrochem.*, 1898, **5**, 52—76).—The E.M.F. required to separate each of the anions which may occur in alkaline solutions of the alkali chlorides during electrolysis, is determined by the method described by Glaser (this vol., ii, 78). A large, platinised platinum cathode saturated with hydrogen is employed throughout. In normal sodium hydroxide solution, the hydroxyl ion is discharged at 1·69 volts, whether the solution contains sodium chloride or not. The chlorine ion is separated from a solution containing $1NaCl + 0{\cdot}01NaOH$ (in gram-molecules per litre) at 2·07 volts, and from a solution containing $1NaCl + 0{\cdot}001NaOH$ at 2·00 volts. These numbers are in good agreement with those calculated from the E.M.F. of the chlorine-hydrogen gas cell and the dissociation of pure water, namely, 2·01 and 1·96 respectively. Chlorine is, therefore, a primary product of the electrolysis. When sodium hypochlorite is added to the solution, no new decomposition point is found, the $\overline{ClO}$ ion being probably oxidised before its discharge point is reached, the reaction being $2\overline{ClO} + \overline{OH}(++) = HClO_3 + \overline{Cl}$. The $(++)$ sign indicates that two positive charges of electricity are required. From a solution containing $0{\cdot}01NaOH + 1NaClO_3$, ClO_3 ions are liberated with 2·36 volts. With small E.M.F.'s, a decomposition point corresponding with the separation of $\overline{\overline{O}}$ ions is found at 1·08 volts, and another of unknown significance between 1·36 and 1·42 volts; the two latter are not well marked. In the electrolytic experiments described, the conditions are kept as simple as possible by passing small currents for short periods of time at a definite E.M.F., by keeping the cathode and anode solutions separate, and by taking the composition of these such that it shall not be much changed by the products of the electrolysis (20 per cent. $NaCl + 4$ per cent. $NaOH$). The hydrogen electrode is always used as cathode. Beginning with the smallest E.M.F. with which a continuous current can be maintained (about 1·2 volts), the yield of hypochlorite is almost equal to the theoretical amount; with higher E.M.F.'s, it falls off rapidly, reaching 40 per cent. at 1·3 to 1·4 volts, and 2·23 per cent. at 1·44 to 1·5 volts. This initial formation of hypochlorite is attributed to the reaction $\overline{Cl} + \overline{\overline{O}}(++) = \overline{ClO}$. The rapid fall in the yield of hypochlorite at 1·4 volts, and the occurrence of a decomposition point at this E.M.F., show that some new change takes place here, possibly $\overline{\mathrm{ClO}} + \overset{--}{\mathrm{O}}(+\,+) = \overline{\mathrm{Cl}} + \mathrm{O}_2$. As a matter of fact, a solution of sodium hypochlorite diminishes in strength if electrolysed with 1·43 volts. Chlorate is formed with 1·8 volts and upwards. The total yield of chlorate and hypochlorite then increases with the E.M.F., the ratio of hypochlorite to chlorate diminishing. When the solution is allowed to flow slowly over the anode, the total yield of hypochlorite and chlorate, as well as the relative amount of hypochlorite, is increased. Further, if the electrolysis of the same solution is continued, the yield of chlorate increases, whilst that of hypochlorite diminishes. These results confirm the conclusion drawn from the decomposition curves, namely, that the formation of hypochlorite is due to the secondary, chemical action of chlorine on the alkali present, the chlorate being formed from it in the way represented by the equation $2\overline{\mathrm{ClO}} + \overline{\mathrm{OH}}(+\,+) = \mathrm{HClO}_3 + \overline{\mathrm{Cl}}$. T. E.

Influence Exercised by Temperature and by certain Metallic Oxides in the Formation of Sodium Sulphate from Sulphurous Anhydride, Air, and Sodium Chloride. By JEAN KRUTWIG and A. DERNONCOURT (*Rec. Trav. Chim.*, 1898, **17**, 349—358).—The authors have extended the observations described in a former paper (Abstr., 1898, ii, 24) by studying the influence of temperature, measured by a Le Chatelier's pyrometer, on the changes there considered. In one series of experiments, 1·097 grams of iron pyrites was heated in a hard glass tube with 2·028 grams of sodium chloride and 4·0 grams of ferric oxide during 3—4 hours at fixed temperatures between 350° and 750°, whilst a current of air (6—11·5 litres) was passed through the tube. A curve is given which indicates that the transformation of the sodium chloride into sulphate increases regularly with the temperature between 350° and 525°, the yield being then a maximum (71·01 per cent.). Above 525°, the yield of sulphate diminishes, albeit somewhat irregularly, until, at 750°, it amounts only to about 32 per cent. In a second series of experiments, in which the quantity of ferric oxide was doubled, the influence of temperature appeared to be somewhat irregular between 410° and 650°, the yield of sulphate being a maximum (74·8 per cent.) at 490°. Comparing the experiments of the first series with those of the second, it appears that, under equal conditions of temperature, an increase in the amount of ferric oxide is accompanied by an increase in the conversion of chloride into sulphate; in both series, the conversion is a maximum at about 500°. Attention is drawn to the fact that if, in these experiments, amorphous ferric oxide is employed, it is converted into a crystalline modification consisting of small, lustrous scales.

When the ferric oxide in the two series of experiments above described is replaced by an equal weight of cupric oxide, a much more complete conversion of chloride into sulphate is effected, although the temperature at which this is a maximum remains unchanged. In the first series, the yield (73—71 per cent.) varies little between 330° and 450°, although it shows a marked decrease at 510° (57·5 per cent.), followed by a slight but regular increase as the temperature is raised to 650° (64·2 per cent.); in the second series, there is little difference in the amount of conversion at temperatures between 360° (95·5 per cent.) and 640° (98·2 per cent.).

Two experiments, using ferric and cupric oxides respectively, were carried out at 350°, oxygen being used to replace the air in the above method; the yield of sulphate in each case was thereby greatly increased. W. A. D.

Displacement of Metals by Hydrogen. By ALBERT COLSON (*Compt. rend.*, 1898, **127**, 961—963).—Silver phosphate is slowly attacked by dry hydrogen in the dark at the ordinary temperature, with liberation of phosphoric acid and metallic silver. The action is greatly accelerated by increase of temperature, and the metal liberated at 100° is white instead of black; pressure also accelerates the change. Silver pyrophosphate is not attacked at the ordinary temperature, but reduction takes place slowly at 100°. Silver sulphate is not affected at 100°, but the change begins at about 125°, and its rate increases with rise of temperature. Silver hydroxide is attacked at the ordinary temperature. The action of hydrogen seems to be unaffected by simultaneous exposure to light.

Cupric sulphate is not attacked by hydrogen at the ordinary temperature, but absorption of the gas begins at about 250°. C. H. B.

Silver Bisulphide. By ARTHUR HANTZSCH (*Zeit. anorg. Chem.*, 1898, **19**, 104—105).—*Silver bisulphide*, Ag_2S_2, is obtained by adding a solution of sulphur in carbon bisulphide to a solution of silver nitrate in benzonitrile; the precipitate, after remaining for 24 hours in a closed flask, is washed with benzonitrile and carbon bisulphide, and then with alcohol and ether, and quickly dried on a porous plate. It is a brown, amorphous powder which oxidises very rapidly when damp, yields a solution of silver sulphate when shaken with water, and does not lose sulphur when extracted with carbon bisulphide; it melts to a red liquid when heated, and then gives off sulphur and sulphurous anhydride, leaving a residue of metallic silver. When treated with dilute hydrochloric acid, it yields sulphur, hydrogen sulphide, and silver chloride, whilst nitric acid dissolves it with liberation of sulphur. Silver bisulphide can only be prepared from a solution of benzonitrile; when other solvents are used, silver sulphide is obtained.

When a solution of silver nitrate in benzonitrile is treated with ammonia, a precipitate of silverdiammine nitrate, $Ag(NH_3)_2NO_3$, is obtained. E. C. R.

Preparation of Thioantimonites and Thioarsenites of Silver, Copper, and Lead by a Dry Method. By HERMANN SOMMERLAD (*Zeit. anorg. Chem.*, 1898, **18**, 420—447).—The details of the method employed for the preparation of these compounds have already been described (Abstr., 1897, ii, 500).

The compound Ag_5SbS_4, obtained by heating a mixture of silver chloride and antimony sulphide in the proportion $15AgCl:4Sb_2S_3$, is black, has the sp. gr. = 6·100, and shows the same chemical reactions as pyrargyrite and miargyrite. The product obtained by melting a mixture of silver sulphide and antimony sulphide is iron black and has the sp. gr. = 6·173.

Artificial polyargyrite is obtained by melting silver chloride and antimony sulphide in the proportion $24AgCl : 5Sb_2S_3$ and then reheating the melt with more antimony sulphide; the product is of a dark lead grey colour, gives a red powder, and has the sp. gr. = 5·730 (the sp. gr. of natural polyargyrite = 6·974). It is also obtained by melting a mixture of silver sulphide and antimony sulphide, when a dark iron grey ductile mass of sp. gr. = 6·500 is obtained.

Artificial proustite, prepared by fusing its components together, is similar to the product obtained from silver chloride and arsenic sulphide, which has already been described. The compound $AgAsS_2$ is obtained by heating a mixture of silver chloride and arsenic sulphide in the proportion $3AgCl : 2As_2S_3$, when the reaction commences at 170° and is completed by heating with the bare flame; the product is a reddish-black, crystalline substance which gives a brownish-red powder, and has the sp. gr. = 4·700. When subjected to prolonged heating at a high temperature, it is converted into a substance having the appearance and properties of proustite.

Silver pyrothioarsenite, $Ag_4As_2S_5$, is obtained by carefully heating a mixture of silver chloride and arsenic sulphide in the proportion $12AgCl : 5As_2S_3$. The product, a lustrous, black mass of sp. gr. = 4·886, has a conchoidal fracture, gives a dark red streak and powder, and reacts with acids and alkali sulphides in the same way as proustite. When cautiously heated, it melts without evolution of arsenic sulphide, and when heated for some time in a current of hydrogen sulphide, is converted into a reddish-black melt having the composition of proustite. The compound Ag_5AsS_4, obtained by melting its components, is an iron grey, crystalline mass having the sp. gr. = 5·517, but when prepared from silver chloride and arsenic sulphide, it has the sp. gr. = 5·547. The compound $Ag_{24}As_2S_{15}$, obtained by melting silver sulphide with arsenic sulphide ($12Ag_2S : As_2S_3$), is a crystalline, black mass of sp. gr. = 6·279 which melts without evolution of arsenic sulphide, and is decomposed by hot solutions of potassium hydroxide and alkali sulphides. The author was unable to obtain this compound from silver chloride and arsenic sulphide.

Artificial wolfsbergite, $CuSbS_2$, is obtained on heating a mixture of cuprous chloride and antimony sulphide in the proportion $3CuCl : 2Sb_2S_3$, the reaction commencing at 130°, but requiring a high temperature to complete it. The product is a steel grey, crystalline melt with a slight copper lustre, is easily broken into a black powder, and has the sp. gr. = 4·885 (natural wolfsbergite has the sp. gr. = 4·7—4·8). It is easily melted when heated in a glass tube, gives a clear solution with nitric acid in the presence of tartaric acid with precipitation of sulphur, and is not attacked by ammonia, but is decomposed by hot potassium hydroxide or alkali sulphides. The product obtained by melting a mixture of copper sulphide and antimony sulphide is similar and has the sp. gr. = 4·979. Artificial guejarite, $Cu_2Sb_4S_7$, obtained in a similar manner to the preceding compound, is very similar to artificial wolfsbergite, and has the sp. gr. = 4·814. The sp. gr. of natural guejarite = 5·03. The compound Cu_3SbS_3, obtained by melting cuprous chloride with antimony sulphide, is a black, brittle mass, and has the sp. gr. = 5·182. The product prepared from copper sulpide and antimony sulphide has the sp. gr. = 5·113.

The author was unable to obtain copper thioarsenites of definite composition. When a mixture of cuprous chloride and arsenic sulphide in the proportion requisite for the formation of binnite, $Cu_6As_4S_9$, is heated, reaction commences at 200—300° and arsenic chloride mixed with arsenic sulphide distils over. The product is a black mass which does not melt when heated over the free flame, has the sp. gr. = 4·289, is decomposed by acid, potassium hydroxide, and alkali sulphides, and has a composition closely approximating to that required by the formula $Cu_4As_2S_5$.

The preparation of thioantimonites of lead from lead chloride and antimony sulphide requires a high temperature, and only a few of them can be prepared by this method as the melt contains unaltered lead chloride after the antimony sulphide has commenced to sublime. Zinckenite and jamesonite, which, for their preparation, require the proportion of antimony sulphide to lead chloride to be about 1 : 1, are more easily prepared than boulangerite, which requires the proportion 1 : 1·2 whilst meneghinite, which requires the proportion 1 : 1·4, cannot be prepared by this method. Artificial zinckenite, $PbSb_2S_4$, prepared by heating a mixture of lead chloride and antimony sulphide in a blast furnace, is a steel grey, fibrous mass of sp. gr. = 5·320 (the sp. gr. of the natural mineral = 5·3) of similar appearance to antimonite, and gives a dark grey streak and powder. It is decomposed by hydrochloric acid with evolution of hydrogen sulphide, dissolves in nitric acid in the presence of tartaric acid without precipitation of lead sulphate, and is decomposed by hot potassium hydroxide and alkali sulphides. A similar product is obtained on melting a mixture of lead sulphide and antimony sulphide in an atmosphere of hydrogen sulphide, and has the sp. gr. = 5·280.

Artificial jamesonite, $Pb_2Sb_2S_5$, prepared in a similar manner from lead chloride, resembles the preceding compound, but is darker in colour; sp. gr. = 5·832 (the sp. gr. of the natural mineral = 5·6—5·8), but when prepared from lead sulphide and antimony sulphide, the sp. gr. = 5·750. Artificial boulangerite, $Pb_3Sb_2S_6$, prepared from lead chloride, is a steel grey, crystalline mass of sp. gr. = 5·871 (the sp. gr. of the natural mineral = 5·8—6·0), gives a greyish-black streak and powder, and resembles zinckenite as regards chemical behaviour. The product prepared from lead sulphide has the sp. gr. = 5·860. The product prepared by precipitating a solution of lead acetate with sodium thioantimonate and melting the precipitate in an atmosphere of hydrogen sulphide is similar to the preceding, and has the sp. gr. = 5·907. Meneghinite, geocronite, and kilbrickenite cannot be prepared from lead chloride; the melts always contain lead chloride, which cannot be completely extracted by hot water. When prepared by melting mixtures of lead sulphide and antimony sulphide in the requisite proportions, lead grey, crystalline compounds are obtained which are similar to the natural minerals. Artificial domingite, $Pb_3Sb_4S_9$, prepared from lead chloride, is a dark grey mass, showing on a fracture long, radiating needles, and has the sp. gr. = 5·632. A similar product is obtained from lead sulphide, and has the sp. gr. = 5·605. Artificial plagionite, $Pb_5Sb_8S_{17}$ prepared from lead chloride, is a lead coloured, granular melt, and has the sp. gr. = 5·500. (The sp. gr. of the monoclinic natural mineral = 5·4). The product obtained from lead sulphide is composed of slender crystals, and has the sp. gr. = 5·447.

The preparation of lead thioarsenites from lead chloride and by melting their components is difficult, since they are easily decomposed by heat with sublimation of arsenic sulphide. When lead sulphide and arsenic sulphide are melted together in the proportion required for the formation of scleroclase, $PbAs_2S_4$, a black, lustrous melt of the required composition is obtained; it has the sp. gr. = 4·585, is decomposed by ammonia, and gives a black streak and powder, whereas natural scleroclase gives a reddish-brown streak, and has the sp. gr. = 5·393. When the preceding product is heated in a current of hydrogen sulphide, a greyish-black, porous mass is obtained which has the sp. gr. = 5·590 and a composition closely approximating to that of dufrenoysite, $Pb_2As_2S_5$; when heated at a higher temperature as long as arsenic sulphide is volatilised, a product is obtained having a composition closely approximating to that of jordanite, $Pb_4As_2S_7$. The author was unable to obtain artificial scleroclase from lead chloride and arsenic trisulphide; the product contains lead chloride at temperatures below that of the blast furnace, and at the higher temperatures consists of lead sulphide containing about 4 per cent. of arsenic sulphide. A product of the composition of dufrenoysite, $Pb_2As_2S_5$, is obtained by fusing a mixture of lead sulphide and arsenic sulphide; it is a steel grey, lustrous mass, consisting of slender needles, has the sp. gr. = 5·505, and is decomposed by ammonia. Artificial guitermanite, $Pb_3As_2S_6$, obtained by melting its components, is a lead grey, crystalline mass of sp. gr. = 5·860, and is similar to artificial boulangerite. Artificial jordanite, $Pb_4As_2S_7$, obtained by melting its components, is a lead grey product of sp. gr. = 6·101, and is not attacked by ammonia.

E. C. R.

Calcium and Calcium Hydride. By BÉLA VON LENGYEL (*Chem. Centr.*, 1898, ii, 262; from *Math. naturw. Ber. Ungarn*, **14**, 180—188).—The author has obtained calcium by electrolysing anhydrous calcium chloride in a graphite crucible containing a porous earthenware cell, the former being connected to the positive and the latter to the negative pole by means of iron wire; a current of 10—18 ampères at 70—110 volts is employed. After removing the excess of calcium chloride by allowing the regulus to remain in anhydrous ether, a material containing 99·2 per cent. of calcium may be obtained. The metal has a sp. gr. = 1·5540 at 18°, and its properties correspond with those of Mathiessen's preparation; it has the colour of a gold alloy rich in silver, and is not affected by cold dry air, but burns with a dazzling light when heated to bright redness; it also burns in chlorine and in sulphur vapour, but combines with iodine without emitting light. From concentrated or dilute hydrochloric acid and from water, calcium liberates hydrogen, but it is not attacked by concentrated sulphuric or concentrated nitric acid unless boiled with it.

Calcium unites with hydrogen at the ordinary temperature to form the hydride, CaH_2, and at a red heat the action is very energetic; the hydride is a greyish, earthy substance, and decomposes water more readily even than the metal, the hydrogen often inflaming. It burns in oxygen at a red heat, emitting a brilliant light, combines energetically with chlorine at a red heat, glows when heated in iodine vapour, and falls to a grey dust when heated in sulphur vapour. Towards acids, calcium hydride behaves like calcium itself, but it attacks ether with violence.

The author has not succeeded in preparing metallic barium, and finds that strontium is more difficult to obtain than calcium.

E. W. W.

Impurities of Commercial Calcium Carbide. By HENRI LE CHATELIER (*Bull. Soc. Chim.*, 1897, [iii], **17**, 793—794).—The chief impurities of calcium carbide are silicon and iron, and a study of the state of combination in which these elements exist in the compound is interesting as affording evidence as to their relative affinities at a temperature of about 2000°, the point of solidification of calcium carbide. The iron is always wholly combined with silicon, and by treating the carbide with water and acids, small crystals of the silicide of iron, $SiFe_2$, studied by Moissan are obtained. The remainder of the silicon combines either with carbon or calcium, according to the relative proportions of the latter. If the carbon is in excess, hexagonal plates of carbon silicide, generally of a blue colour, are formed; if, however, there is an excess of calcium, calcium silicide is formed and may be obtained in the form of metallic grains having the lustre and colour of zinc. Two varieties of calcium silicide appear to exist; the one scarcely acted on by nitric acid, but readily attacked by hydrochloric acid with the formation of a yellow, insoluble substance; and the other readily acted on by nitric and acetic acids, and giving a white deposit with hydrochloric acid which, like the yellow substance, dissolves in caustic potash with the evolution of hydrogen. As a rule, on treating calcium silicide with hydrochloric acid, a mixture of the white and yellow substances is obtained, ranging in composition between $Si_2O_4H_4$ and $Si_2O_3H_4$. N. L.

Colour of Calcium Carbide. By HENRI MOISSAN (*Compt. rend.*, 1898, **127**, 917—918).—Calcium carbide, obtained by the dissociation of the compound $C_2Ca,C_2H_2,4NH_3$ (this vol., i, 241) is white and transparent like the alkali carbides, whereas the calcium carbide prepared in the ordinary way in the electric furnace has an iridescent, metallic appearance, and is only partially transparent in thin layers. If, however, the materials from which the carbide is prepared are free from iron, it is also white and transparent when prepared by the action of heat on a mixture of carbon with either the metal, its hydride, or its nitride.

C. H. B.

Electrolysis of Solutions of Calcium Chloride. By FELIX OETTEL (*Zeit. Elektrochem.*, 1898, **5**, 1—5).—The results obtained by Foerster and Bischoff (this vol., ii, 89) are confirmed by the author's experiments. If the solution of calcium chlorate obtained electrolytically is treated with potassium chloride, potassium chlorate crystallises out, and the mother liquor containing calcium chloride mixed with a little potassium chloride may again be electrolysed. The yield of chlorate thus obtained is good at first, but quickly diminishes, much free chlorine being evolved, and solid crusts formed at the cathode. The author believes that, when pure calcium chloride is employed, lime dissolves in the form of calcium oxychloride, and that the presence of potassium chloride diminishes the solubility of this substance so much that lime cannot dissolve in sufficient quantity to combine with all the chlorine liberated at the anode. The presence of copper salts in the electrolyte brings about rapid catalytic decomposition of the hypochlorite, oxygen being evolved. Ferric oxide, lead peroxide, or nickel peroxide behave similarly. The author ascribes the formation of chlorate to two reactions; (*a*) the oxidation of hypochlorite, formed from chlorine and alkali hydroxide, either by chlorine or by oxygen liberated by the electrolysis, (*b*) the direct union of chlorine and oxygen during their simultaneous liberation at the anode. In neutral solutions, the first, in strongly alkaline solutions, the second, process is the principal one. T. E.

Calcium and Magnesium Hydrogen Carbonates. By KARL KIPPENBERGER (*Zeit. anorg. Chem.*, 1898, **17**, 413—417), and FREDERICK PEARSON TREADWELL (*ibid.*, 418—419).—In a recent paper by Treadwell and Reuter (Abstr., 1898, ii, 473), Kippenberger's views as to the existence of magnesium hydrogen carbonate were unintentionally misrepresented: he holds that it can only exist in presence of free carbonic acid (compare Abstr., 1894, ii, 281).

Electrolysis of Solutions of Zinc Chloride and the Nature of Spongy Zinc. By FRITZ FOERSTER and O. GÜNTHER (*Zeit. Elektrochem.*, 1898, **5**, 16—23).—A perfectly neutral solution of zinc chloride containing 54·6 grams of zinc per litre was electrolysed with a cathodic current density of 1·4 ampères per square decimetre. The anode consisted of pure electrolytic zinc. For several hours, the deposit consisted of smooth, light-grey zinc; after 20 hours, the solution became turbid owing to the separation of zinc oxychloride, and zinc sponge was deposited. The solution then contained 1 molecule of ZnO to $14\,ZnCl_2$. By using a small, subsidiary platinum anode, a small quantity of chlorine was continuously supplied to the solution; this did not, however, prevent the formation of the sponge. Zinc chloride solutions, whether acid or alkaline originally, always become basic after a time, owing to the energetic oxidation of the zinc electrodes by atmospheric oxygen in presence of zinc chloride, and the formation of the zinc sponge always begins when the solution is saturated with zinc oxide. From a solution containing 1/20 to 1/30 gram-molecule of hydrochloric acid per litre, zinc may be deposited in any quantity without the spongy deposit appearing. Under these circumstances, some hydrogen is evolved, the bubbles of which remain persistently attached to the cathode, producing unevenness in the deposit. The presence of a little free chlorine (0·2 gram per litre) is useful in preventing this prolonged adherence to the same point. By this method, perfect deposits of zinc, quite free from arsenic, were also obtained when impure zinc anodes were used.

Schnabel has stated that Ashcroft obtained considerably (50 per cent.) more than the theoretical amount of zinc in the electrolysis of solutions of basic zinc salts. The authors have failed to obtain any indication of such results.

It is, finally, shown in detail that all definitely ascertained facts relating to the formation of spongy zinc point to the conclusion that it is produced whenever the condition of the solution at the cathode is such that basic zinc salts or zinc hydroxide may separate out there.

T. E.

Solubility of Salts. II. Solubility of the Halogen Salts of Zinc and Cadmium. By RUDOLF DIETZ (*Ber.*, 1899, **32**, 90—96).—Zinc chloride forms no fewer than five different hydrates, the solubility of each of which can be determined for a certain range of temperature; numbers have been obtained for the hydrate with $3H_2O$ from $-5°$ to $+7°$ at which it melts; for the hydrate with $2\frac{1}{2}H_2O$ from 0° to its melting point at 13°; for the hydrate with $2H_2O$ from 0° to its melting point at 19°; for the hydrate with $1\frac{1}{2}H_2O$ from 0° to its melting point at 26°; for the hydrate with $1H_2O$ from 0° to 27°; and for the anhydrous salt from 15° to 100°. Above 23°, the anhydrous salt is in a stable condition, whilst below that temperature it is unstable and readily passes into the modification with $1\frac{1}{2}H_2O$. Zinc bromide only forms two hydrates. The solubility of that with $3H_2O$ can be followed from $-15°$ to the melting point at $-5°$; of that with $2H_2O$ from $-8°$ to the melting point at 37°; and of the anhydrous salt from 33° to 100°. The curve consists of three branches intersecting at $-8°$ and at $+35°$. Zinc iodide only forms a single hydrate, which contains $2H_2O$, the solubility of which has been determined from $-10°$ to 27°, its melting point, whilst the solubility of the anhydrous salt has been determined from 0° to 100°. The curve of solubility consists of two branches, intersecting at 0°, the anhydrous salt being stable above this temperature. Only three hydrates of cadmium chloride, containing 1, $2\frac{1}{2}$, and $4H_2O$, have been obtained, the author having been unable to prepare those containing 2 and $5H_2O$. The curve for the hydrate with $4H_2O$ extends from $-9°$ to $+15°$; that for the hydrate with $2\frac{1}{2}H_2O$ extends from $-10°$ to $+36°$; that for the hydrate with $1H_2O$ from $+10°$ to 100°. The solubility curve consists of three branches, intersecting at $-5°$ and $+34°$. An isomeride of the hydrate with $2\frac{1}{2}H_2O$ is deposited in compact needles when a 50 per cent. solution of the salt is evaporated over sulphuric acid, but it is so unstable that its solubility cannot be determined. Cadmium bromide only forms a hydrate with $4H_2O$, all attempts to prepare one with $2\frac{1}{2}H_2O$ having proved unsuccessful; the curve for the hydrate extends from 0° to 38°; whilst that for the anhydrous salt extends from 35° to 100°, and intersects that of the hydrate at 36°. Cadmium iodide is only known in the anhydrous state, the solubility increasing from 44·39 per cent. at 0° to 56·08 per cent. at 100°.

A. H.

Dissociation of Minium. By HENRI LE CHATELIER (*Bull. Soc. Chim.*, 1897, [iii], **17**, 791—792).—The following dissociation pressures were observed, the substance being placed in a porcelain tube heated by a platinum spiral traversed by an electric current and connected below with a glass tube dipping into mercury.

Temperature ...	455°	500°	555°	636°
Pressure.........	5 mm.	60 mm.	183 mm.	763 mm.

From these results, it appears that in air containing oxygen at a partial pressure of about 150 mm., minium cannot be formed above 550°. Oxidation takes place most rapidly at about 500°.

The allotropic transformation of lead monoxide takes place at 580°, and its melting point was found to be 830°. It is shown how the author's results explain the absorption of oxygen by melted litharge and its evolution on solidification. N. L.

Compounds of Lead Iodide with other Iodides. By A. MOSNIER (*Ann. Chim. Phys.*, 1897, [vii], 374—426).—The author continues the study of the double salts obtained from lead iodide and the iodides of lithium, sodium, rubidium, ammonium, tetramethylammonium, tetrethylammonium, and phenylammonium; their heats of formation are always positive, whether the salt is anhydrous or hydrated. In the case of the double iodides with calcium, strontium, and barium (compare Abstr., 1895, ii, 268), the heat of formation of the anhydrous salt is negative, whereas that of the hydrated compound is positive. A further number of double iodides have been prepared, whose heats of formation are always positive, whether determined for the anhydrous or the hydrated salt. Some of these may be arranged in groups having the following general formulæ: $PbI_2,2MI_2$, where $M = Mg$, Zn, or Cd; $PbI_2,2M_1I_2 + 3H_2O$, where $M_1 = Fe$, Mn, Cr, Ni, or Co; and $3PbI_2,RI_3 + 12H_2O$, where $R = P$, As, Sb, or Bi. Besides those included in the preceding groups, there are others such as the stannous and aluminium compounds, $SnI_2,PbI_2 + 8H_2O$ and $Al_2I_6,3PbI_2 + 10H_2O$; the composition $Be_2I_6(?),3PbI_2 + 10H_2O$ is given to the beryllium double salt. All the double iodides except those with the quaternary ammonium bases are decomposed by water. Mercuric iodide does not form a double salt with lead iodide. Although thallium and barium resemble lead in some respects, they do not form analogous series of double iodides. Some few double lead bromides resemble the corresponding iodides in composition. G. T. M.

Metallic Triple Nitrites. By CARL PRZIBYLLA (*Zeit. anorg. Chem.*, 1898, 18, 448—463).—A further examination of the metallic triple nitrites described by the author (Abstr., 1898, ii, 162) shows that they are isomorphous mixtures rather than true chemical compounds. Copper strontium potassium nitrite, the corresponding ammonium salt, copper calcium potassium nitrite, and others, vary in composition according to the relative amounts of the constituent salts which are present, and when recrystallised from water the composition is again altered. The author points out, however, that many of the lead compounds and others are characteristic salts which have a composition agreeing with the required formula, even when prepared from solutions containing varying proportions of their constituents; and the extremely great differences in the solubility of these salts when compared with that of their constituents is difficult to reconcile with the view that they are isomorphous mixtures.

The following new salts are described: *Lead copper thallium nitrite*, obtained by the method previously described, is a brown powder consisting of transparent, microscopic splinters. *Copper barium thallium nitrite* is very similar to the corresponding potassium salt but more sparingly soluble. *Nickel lead thallium nitrite* and *nickel barium thallium nitrite* are obtained as brown, crystalline powders, and are strongly refractive. *Lead iron thallium nitrite* is a deep orange-red powder consisting of microscopic cubes, and is strongly refractive.

E. C. R.

Separation of Cerium from Lanthanum and Didymium, and its Estimation in Presence of the Latter. By P. Mengel (*Zeit. anorg. Chem.*, 1898, **19**, 67—77).—From an examination of the methods employed for the separation of cerium, the author concludes that the best method is by oxidation with sodium dioxide. The cerium solution is treated at the ordinary temperature with a solution of sodium dioxide in ice-cold water, and the reddish-brown precipitate is washed with hot water dried at 120—130°, when it turns bright brown to yellow; it is then dissolved in strong nitric acid, and the cerium precipitated as the ammonium double salt in the usual way.

According to Cleve, the cerium earths are precipitated by ammonia and hydrogen peroxide in the form of oxides of constant composition; but this is not the case when sodium dioxide is employed at the ordinary temperature; oxyhydroxides are then obtained containing more oxygen than the sesquioxide and less oxygen than Cleve's peroxides, and the amount of oxygen varies with the conditions of the experiment, especially with the temperature. When a solution of a pure cerium salt is precipitated with sodium dioxide and boiled, whereby a bright yellow precipitate of cerium dioxyhydroxide is obtained, and this is dried at 130°, and the percentage of CeO_2 in the precipitate estimated with ferrous ammonium sulphate and permanganate, results are obtained which show that the oxidation of the cerium is incomplete. If, however, the precipitate is heated over the blowpipe, the theoretical quantity of dioxide is obtained.

When a mixture of lanthanum and didymium salts, free from cerium, is treated with sodium dioxide in the cold, it yields a precipitate which gives off oxygen when the mixture is warmed; the precipitate, when dried at 120°, is bluish-white, and contains much carbonic anhydride absorbed from the air, which is eliminated only by a high temperature; when heated at 400°, it becomes dark brown, and on further heating over the blowpipe assumes the characteristic grey colour of the anhydrous sesquioxide. The brown coloration is due to the formation of a higher oxide of praseodymium, and since this higher oxide cannot be obtained by the action of chlorine in alkaline solution, the praseodymium peroxide, like barium peroxide, must belong to the type H_2O_2. The oxalates of lanthanum and didymium do not yield the brown oxide when heated; if, however, the grey oxide which is obtained is moistened with nitric acid and cautiously heated, the brown oxide is obtained.

The estimation of cerium in admixture with lanthanum and didymium cannot be effected by determining the excess of oxygen in the precipitate obtained by means of sodium dioxide; the lanthanum and didymium oxides, when dried at 230°, still retain an excess of oxygen, and when the oxides are heated at 400°, the brown praseodymium peroxide combines with the cerium dioxide and forms a compound which is not decomposed at a white heat; consequently, the estimation of the peroxide-oxygen by means of ferrous ammonium sulphate or potassium iodide gives results higher than are required for the cerium dioxide. The same error is, of course, present when the oxides are obtained by heating a mixture of the oxalates. The estimation of cerium in the cerium earths by estimating the peroxide-oxygen in the ignited oxides gives accurate results only when a very small quantity of praseodymium is present. E. C. R.

Condensed Oxides of the Rare Earths. By GRÉGOIRE N. WYROUBOFF and AUGUSTE VERNEUIL (*Compt. rend.*, 1898, **127**, 863—866).—On adding water to a solution of cerosoceric oxide, Ce_3O_4, in nitric acid, a white, gelatinous *precipitate* separates, having the composition Ce_3O_4,HNO_3; when completely dehydrated, this resembles amber, and dissolves completely in water, giving a solution of strongly acid reaction, from which the original compound is reprecipitated on adding dilute nitric or hydrochloric acid. The oxide obtained on decomposing the compound Ce_3O_4,HNO_3 by alkali is very different in character from, and is probably polymeric with, the oxide precipitated from a normal cerium salt such as the nitrate $Ce_3(NO_3)_8$; when moist, it is white, but on drying becomes yellow and horn-like; hot hydrochloric acid only acts on it slowly, but nitric acid regenerates the compound Ce_3O_4,HNO_3.

It is usually stated that the oxide obtained by igniting cerium oxalate is not acted on by nitric acid, but this is only true when the temperature of ignition exceeds 1500° and the oxide obtained is perfectly white. When the calcination is carried out below 500°, a very dense, canary-yellow *modification* of the oxide Ce_3O_4 is obtained, which is transformed by 2—3 per cent. nitric acid into a white, gelatinous *substance*, which readily dissolves in water. The aqueous solution has an acid reaction, is opalescent, and on adding 2 per cent. nitric acid gives a *precipitate* having the composition $(Ce_3O_4)_5,HNO_3$, when dried; when decomposed by alkalis, this gives an *oxide*, white when moist, yellow when dry, which is not acted on by concentrated hydrochloric acid, either alone or in presence of potassium iodide.

When solutions of the compounds Ce_3O_4,HNO_3 and $(Ce_3O_4)_5,HNO_3$ are decomposed by an excess of dilute sulphuric acid, *substances* completely insoluble in water are obtained which no longer contain nitric acid, although only half that originally present has been replaced by sulphuric acid; on this account, the authors ascribe to the original nitrates the formulæ $(Ce_3O_4)_4,2H_2N_2O_6$ and $(Ce_3O_4)_{20},2H_2N_2O_6$, and to the sulphates derived from them the formulæ $(Ce_3O_4)_4,H_2SO_4$, and $(Ce_3O_4)_{20},H_2SO_4$. On saturating half the nitric acid of either of the nitrates and adding a little ammonium nitrate, completely insoluble *salts* are obtained which correspond with the oxide $(Ce_3O_4)_{n>20}$, derived from cerium oxalate by ignition above 1500°.

The oxide $(Ce_3O_4)_{20}$ can be reduced to its simpler polymerides by the action of nitric acid at 180°; it initially dissolves, giving a yellow solution from which water precipitates the nitrate $(Ce_3O_4)_4,4HNO_3$, but later produces a red solution containing the normal salt $Ce_3(NO_3)_8$; ultimately, a colourless solution is obtained containing only the nitrate of the protoxide. The oxide $(Ce_3O_4)_4$, similarly, is readily depolymerised in contact with warm nitric acid.

When thorium oxalate, nitrate, chloride or hydroxide is carefully ignited, a product is obtained which in general consists of a mixture of two polymerides of the oxide ThO; these do not dissolve in nitric or hydrochloric acid, but combine with both to form salts soluble in water. From the aqueous solutions thus obtained, the two polymerides separate in succession on carefully adding increasingly concentrated nitric acid; the *nitrate* which first separates has the composition $(ThO)_{12},HNO_3$, whilst the formula of the salt separating later is $(ThO)_5,HNO_3$, or possibly $(ThO)_4,HNO_3$. Since these nitrates behave towards sulphuric acid in the same manner as the corresponding cerium salts described above, their formulæ seem to be respectively $(ThO)_{48},2H_2N_2O_6$ and $(ThO)_{20},2H_2N_2O_6$.

Lanthanum and didymium oxides yield only the normal, insoluble salts, $(LaO)_4,2HNO_3$ and $(DiO)_4,2HNO_3$, described by Marignac, but from yttrium are derived the normal salt $(YO)_4,2HNO_3$, and the acid salt $(YO)_4,4HNO_3$. It thus appears that the property of condensing and giving rise to acid as well as normal salts is a general property of the rare earths.

Generalising from their results, the authors suggest that the so-called "basic salts" are formed by successive polymerisation of the metallic oxide from which they are derived, this process being accompanied necessarily by a change in the valency of the oxide; the basic salts of bismuth, lead, and mercury are cited as examples.

W. A. D.

Crystalline Double Oxides obtained at High Temperatures. By Em. Dufau (*Ann. Chim. Phys.*, 1897, [vii], 12, 257—288).—A *résumé* of work already published (compare Abstr., 1896, ii, 167, 524, 647; 1897, ii, 100, 145).

G. T. M.

Properties of Aluminium. By Alfred Ditte (*Compt. rend.*, 1898, **127**, 919—924).—It is generally believed that aluminium is not attacked by water or dilute acids, but this result is really due to the formation, at the surface of the metal, of a layer of gas which adheres strongly and prevents further access of the liquid. If this layer of gas is removed by mechanical means, or if the action takes place in a vacuum, the aluminium is completely dissolved by acetic, citric, oxalic, tartaric, and other acids. Similarly, the resistance of the metal to the action of solutions of salts, such as the halogen salts of the alkalis, which should attack it with considerable development of heat, is due to the formation of a protective film of aluminium hydroxide. If a small quantity of a dilute acid is added, the oxide is dissolved and the action of the saline solution continues. A mixture of sodium chloride solution and dilute acetic acid, for example, will dissolve aluminium so long as any free acid remains, although neither the acid nor the saline solution would attack the metal more than superficially. Halogen salts of calcium and magnesia behave similarly.

Alkali carbonates dissolve aluminium almost as readily as alkali hydroxides; hydrogen is liberated and an alkali aluminate and a hydrogen carbonate are formed. Ammonia solution, concentrated or dilute, also attacks the metal so long as the aluminate dissolves in the excess of alkali, but the action ceases when a film of the aluminate begins to form on the metal.

It follows generally that aluminium is much more liable to be attacked than is commonly supposed, and is unsuitable for the construction of cooking utensils and the like. C. H. B.

Preparation of Cobaltammine Salt. By SOFUS M. JÖRGENSEN (*Zeit. anorg. Chem.*, 1898, **19**, 78—80).—The hexammine chloride always contains a small quantity of chloropentammine chloride. This is easily removed by recrystallisation from a small quantity of 5 per cent. ammonia, when it is converted into basic aquopentammine chloride which remains in the mother liquors.

Chloropentammine chloride, which, when prepared by the ordinary methods, always contains a small quantity of the hexammine chloride, cannot be separated from this compound by recrystallisation from dilute hydrochloric acid. It is purified as follows: the crude salt (20 grams) is dissolved in ammonia water (2 per cent. 250 c.c.), the filtrate is mixed with a solution of sodium pyrophosphate (4 per cent. 100 c.c.), and then with concentrated ammonia (700 c.c.) and allowed to remain with occasional stirring. The sodium hexammine pyrophosphate is precipitated, and the aquopentammine salt in the filtrate is converted into chloropentammine chloride by heating with concentrated hydrochloric acid on the water-bath. This reaction affords a good method for the detection of small quantities of the hexammine chloride. The salt (0·2 gram) is dissolved in dilute hydrochloric acid and boiled, and the cold filtered solution treated with a solution of sodium pyrophosphate and ammonia; in the presence of 0·2 per cent. of hexammine chloride, a precipitate is formed after 7 hours; with 2·0 per cent., a precipitate is formed in 2 minutes. E. C. R.

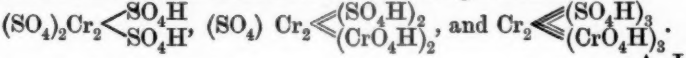
Chromosulphochromic Acids. By ALBERT RECOURA (*Bull. Soc. Chim.*, 1897, [iii], **17**, 934—938. Compare Abstr., 1893, ii, 470 and 528; 1896, ii, 27, and 1897, ii, 172).—The author has already shown that the green sulphate of chromium forms compounds with one, two and three molecular proportions of sulphuric acid yielding definite salt-forming acids. An analogous series of compounds are obtained by its union with chromic acid; they have the compositions $Cr_2(SO_4)_3,CrO_4H_2$, $Cr_2(SO_4)_3,2CrO_4H_2$, and $Cr_2(SO_4)_3,3CrO_4H_2$ respectively, and are termed by the author chromosulphochromic acids.

When molecular proportions of green chromium sulphate and potassium chromate are simultaneously dissolved in water, the solution gives no precipitate with barium chloride or silver nitrate; if two molecular proportions of potassium chromate or chromic acid be employed, the same result is obtained, and the product on evaporation and subjection to a temperature of 150° is no longer soluble in water, and the latter statement is also true of the product obtained by using three molecular proportions of chromate. The use of more than three molecular proportions of chromate leads to the formation of a solution which gives a precipitate with silver nitrate, hence the limit of combination has been passed.

In order to isolate the acids, the liquids are evaporated to dryness on the water-bath, when they are obtained in the form of green, amorphous substances, and the salts may be dealt with in a similar manner. In the dissolved state, the substance containing one molecular proportion of chromate is yellowish-green, with two molecular proportions, greenish-brown, and with three molecular proportions, brown; the last form does not appear to be capable of existence in the solid state, as it becomes covered with a yellowish efflorescence due to separation of chromate.

The compounds are very unstable, and are readily resolved into their components; thus a solution recently made is incapable of yielding precipitates with barium or silver salts, but does so after the lapse of 42 hours; moreover, the above statements regarding the action of barium chloride and silver nitrate solutions only hold true when the solutions are very dilute (1/200 mol. of chromate per litre, and 1/10 mol. of barium chloride or silver nitrate per litre), and in no case does the addition of a solution of lead nitrate fail to produce precipitation.

The study of the heat of neutralisation of the new acids has led to the conclusion that the acids have the following constitutions



$$(SO_4)_2Cr_2{<}\begin{array}{l}SO_4H\\SO_4H\end{array}, \quad (SO_4)\ Cr_2{\ll}\begin{array}{l}(SO_4H)_2\\(CrO_4H)_2\end{array}, \text{ and } Cr_2{\lll}\begin{array}{l}(SO_4H)_3\\(CrO_4H)_3\end{array}.$$

A. L.

Preparation and Properties of Thorium Carbide. By Henri Moissan and Alexandre Étard (*Ann. Chim. Phys.*, 1897, [vii], **12**, 427—432).—Thoria, when heated in the electric furnace with a sufficient quantity of sugar carbon, yields a crystalline carbide (compare Abstr., 1896, ii, 422); when less carbon is employed, a fused mass is produced, consisting of an alloy of thorium and thorium carbide, which is decomposed by water, yielding acetylene, ethylene and its homologues, methane, and hydrogen. The gases evolved from the crystalline carbide consist chiefly of acetylene and methane, whilst hydrogen predominates in the mixture obtained from the above alloy.

G. T. M.

Bismuth Suboxide. By R. Schneider (*J. pr. Chem.*, 1898, [ii], **58**, 562—576).—A severe criticism of Vanino and Treubert's papers (Abstr., 1898, ii, 435, 598); the author upholds the existence of a bismuth suboxide, BiO, prepared long ago by himself (*Ann. Phys. Chem.*, 1853, **88**, 45) and by others. Vanino and Treubert did not obtain this, but metallic bismuth, or a mixture $Bi + Bi_2O_3$ instead, because they did not use 1 mol. only of alkaline stannous chloride, and keep the bismuth solution (1 mol.) always in excess, but added the latter gradually to 3 mols. of the stannous solution. Under these circumstances, the bismuth salt would be completely reduced to the metal, and even in the presence of 1 mol. only of the stannous compound the first third added would be so reduced, in which reaction all the stannous compound would be oxidised to the stannic state, so that the remaining two-thirds of the bismuth salt would be precipitated by the alkali present as the oxide, or, rather, the hydroxide. C. F. B.

Catalytic Action of Platinum and Palladium Sponge. By Alexander de Hemptinne (*Chem. Centr.*, 1898, ii, 884—885; from *Bull. Acad. roy. Belg.*, [iii], **36**, 155—172).—If the catalytic action of platinum is due to its power of condensing gases, then at lower temperatures it should absorb larger quantities of gas; the author finds, however, that platinum sponge absorbs far less hydrogen at − 78° than at 15°, whilst carbon at − 78° absorbs six times as much hydrogen as it does at 15°. Moreover, at the temperature of liquid air (about −190°), platinum sponge still brings about the combination of oxygen and hydrogen, whilst at this temperature even sodium has no action on sulphuric acid. Platinum also absorbs less carbonic oxide at − 78° than at 15°, but as the difference is less in this case than in the case of hydrogen, the absorption of the gas cannot be due to porosity, since the effect of low temperatures would be a greater diminution in the case of carbonic oxide, owing to its larger molecules, than in the case of hydrogen. Palladium behaves towards hydrogen and carbonic oxide in a similar way to platinum; the author found that when palladium which had been exposed to carbonic oxide was cooled to − 78°, then placed in hydrogen, and the temperature allowed to rise, a sudden absorption of gas took place at 20°. This remarkable behaviour of palladium is rather in support of the occlusion hypothesis.

E. W. W.

Mineralogical Chemistry.

Cause of the Absence of Colour in Certain Limpid Natural Waters. By Walthère Spring (*Rec. Trav. Chim.*, 1898, **17**, 359—375. Compare Abstr., 1884, 259, and *Bull. Acad. roy. Belg.*, 1886, [iii], **12**, 814, and 1897, [iii], **34**, 578).—Although it is well recognised that pure water is blue when viewed through a thickness greater than 1 metre, the only natural waters which appear blue are those of mountain streams which have their origin in the ice and snow of great altitudes. Berzelius has stated (*Jahresbericht*, 1830, **9**, 207) that the extraordinarily clear water of Lake Wettern, in Sweden, is perfectly colourless when viewed through a thickness of more than 32 feet, and has hence raised objection to the view that pure water is blue. The author has previously shown (*loc. cit.*) that if water contains one ten-millionth part of its weight of colloidal ferric hydroxide, it no longer appears blue, but green in colour; with quantities greater than this, the colour is yellow or brown. By macerating fragments of a red rock, such as a Devonian schist, during several weeks with frequently renewed hot caustic potash, and subsequently washing with water by repeated decantation, a point is ultimately reached when the red coloring-matter ceases to subside from the washing water, even after standing several months; the particles of suspended ferric oxide (hæmatite) are no longer visible under a magnifying power of 150 diameters, and probably correspond with the dust of the Devonian epoch. On adding a few drops of this turbid solution to a large volume of pure water, the latter is rendered perfectly clear and colourless when viewed through a thickness of 6 metres. When the proportion of ferric oxide, however, is increased, the water quenches more and more of the transmitted light, until it finally becomes opaque, although appearing red by reflected light.

These observations explain the fact that terrestrial waters rarely appear blue. That the waters of Alpine streams are generally blue is probably due to their being entirely free from suspended anhydrous ferric oxide; the cosmic dust with which they are often contaminated consists principally of meteoric iron, which possesses different optical properties from hæmatite, and is incapable of destroying the natural blue colour of the water. W. A. D.

Mud Volcanoes of Achtala. By PETR G. MELIKOFF (*Zeit. anorg. Chem.*, 1898, **19**, 1—10).—The author has examined the mud thrown up by these volcanoes; it has a temperature of 22°, and when allowed to settle yields an opalescent liquid which can be rendered clear by filtration. This liquid has the sp. gr. = 1·015 at 17·5° and contains SiO_2, 0·0018; SO_3, 0·00203; CO_2, 0·0889; Cl, 0·0676; Br, 0·00583; I, 0·001356; CaO, 0·0035; MgO, 0·0118; Na, 0·76026; K, 0·01518; Li, 0·00014 per cent., with a small quantity of organic acids.

The author discusses the formation of the sodium carbonate, and shows that it can be formed by the action of calcium carbonate in the presence of carbonic acid on sodium sulphate or chloride, especially in the presence of colloidal substances like iron or aluminium hydroxides.

The mud from the volcanoes contains 83·68 per cent. of clay (diameter of particles 0·005 mm.) containing amorphous silica and crystals of calcite, orthoclase, and quartz; the coarser portion consists of quartz, orthoclase, sanidine, hornblende, bronzite, and magnetite. The clay also contains 0·008 per cent. of ammonia and amine bases.

E. C. R.

The Black Phosphates of the Pyrenees. By DAVID LEVAT (*Compt. rend.*, 1898, **127**, 834—836).—The author finds that between the upper Devonian marble or "*griotte*" of the Pyrenees and the subjacent schists, there extends a continuous stratum of black material which varies in thickness from 8 to 10 metres, and closely resembles anthracite in appearance; it appears to extend from Oloron, Basses-Pyrénées, throughout the whole length of the mountain chain into Herault, and consists largely of tricalcium phosphate. This formation, which has been mentioned by other observers under the names *black schists, carbonaceous schists, impure anthracite,* and *graphitic stratum* (*couche graphiteuse*), is characterised by there being imbedded in it black, imbricated nodules, which form a quarter to a third of its total mass, and contain from 65—75 per cent. of tricalcium phosphate. The matrix, after removing the nodules, contains from 14—16 per cent. of phosphoric acid; the dull schistose material resembling slate, which is present in the stratum, contains 7·1 per cent. of the same acid, whilst the lustrous schists which envelop the nodules contain 11·7 per cent. The black phosphates are usually impregnated with organic matter, in some cases to the extent of 28 per cent.; the nitrogen present varies from 0·3—0·5 per cent. W. A. D.

Meteorite from Migheja. By Petr G. Melikoff and W. Kschischanowsky (*Zeit. anorg. Chem.*, 1898, **19**, 11—17).—This meteorite fell on June 9th, 1889. It is a somewhat porous mass permeated with amorphous carbon, gives a black streak on paper, and when rubbed a characteristic odour which resembles that of a bituminous substance. Analysis gave,

SiO_2.	CaO.	MgO.	FeO.	MnO.	Na_2O.	K_2O.	Al_2O_3.	FeS.
27·49	2·11	19·85	26·95	0·65	1·37	0·17	1·62	0·46

$NiFe_2$.	Chromite.	P.	S.	SO_3	S_2O_2.	C.	H_2O
3·95	1·62	0·15	3·10	0·85	0·12	2·63	1·40

It contains free sulphur and metallic sulphates, sulphites, and thiosulphites. The free metals are not completely soluble in mercuric chloride. The soluble silicate consists for the most part of olivine of the composition $3(MgO)_2SiO_2,2(FeO)_2SiO_2$. The insoluble silicate is a disilicate of the pyroxene group. E. C. R.

Physiological Chemistry.

Absorption of Proteids. By Lafayette B. Mendel (*Amer. J. Physiol.*, 1899, **2**, 137—141).—By feeding dogs on moderate quantities of a soluble proteid (Witte's peptone), the old view, namely, that proteid is chiefly absorbed by the capillaries of the villi is confirmed. Asher and Barbèra's work, which advanced the view that lymph is due to increased glandular activity and acts as an important channel for proteid absorption, is criticised. W. D. H.

The Basic and Acid Capacity of the Blood and of Proteids. By Karl Spiro and Wilhelm Pemsel (*Zeit physiol. Chem.*, 1898, **26**, 233—271).—The observations, made principally on the blood and serum of the horse, show that these fluids have different acid and basic capacities. By different methods, three values for the alkalinity of the blood were obtained; one corresponds with numbers given by Löwy, and represents the alkalinity of the carbonates and phosphates of the serum (diffusible alkali). The second value is higher, and represents the additional alkalinity due to proteids which unite with alkali (Jaquet's sub-acid substances); this disappears when the proteids are 'salted out' with ammonium sulphate. The third value takes into account the acid capacity of the blood, which is principally a property of the corpuscles. The proteids themselves are hardly considered to function either as acids or bases, for although they are electrically charged, they are not ionised. W. D. H.

Influence of Copper and Zinc Salts on Hæmoglobin Formation. By W. Wolf (*Zeit. physiol. Chem.*, 1899, **26**, 442—461).—Some authors have stated that copper and zinc salts are favourable to hæmoglobin formation, but the present experiments on rats do not confirm this, the amount of hæmoglobin and of red corpuscles being practically the same as in control animals. W. D. H.

Oxyhæmoglobin of the Horse. By D. Lawroff (*Zeit. physiol. Chem.*, 1898, **26**, 343—349).—Horse's oxyhæmoglobin yields 94·09 of proteid, 4·47 of hæmatin, and 1·44 per cent. of other substances; these numbers are rather different from those of Schulz (*Zeit. physiol. Chem.*, **24**, 449), who gives proteid, 86·5; hæmatin, 4·2, and other constituents, 9·2 per cent. The proteid material, globin, is regarded as one *sui generis*; the other materials have not yet been fully investigated, but they yield fatty acids and ammonia. W. D. H.

Iron in Blood-plasma and Leucocytes. By Emil Häusermann (*Zeit physiol. Chem.*, 1899, **26**, 436—437).—Blood was prevented from coagulating by sodium fluoride, and the corpuscles separated from the plasma by the centrifuge. The plasma contains from 1 to 7 milligrams of iron per 100 grams, probably derived from the disintegration of leucocytes; fibrin contains from 9 to 10 milligrams of iron per 100 grams. W. D. H.

Paraglobulin of Blood-serum. By Prosper van de Kerckhof (*Chem. Centr.*, 1898, ii, 494; from *Bull. Acad. roy. Belg.*, [iii], **35**, 562—567).—The author has prepared paraglobulin from the blood-serum of oxen, sheep, swine, and dogs, partly by salting out with magnesium sulphate, and partly by half-saturating with ammonium sulphate. After fractionally coagulating, the paraglobulin obtained from mammals appears to consist of three or four different kinds, distinguished by different temperatures of coagulation and different rotatory powers; one kind is not precipitated by sodium chloride.

E. W. W.

The Suprarenal Capsules. By George P. Dreyer (*Amer. J. Physiol.*, 1899, **2**, 203—219).—The active principle of suprarenal extract is present in the blood of the suprarenal vein, and, therefore, constitutes a true internal secretion. This conclusion is based upon the result (rise of arterial blood pressure) which follows the injection of this blood derived from one dog into the circulation of another; there is no chemical analysis recorded to support the contention. The amount of this substance (again judged by the physiological effect of injection) is increased by electrical stimulation of the splanchnic nerve below the diaphragm, and this nerve is, therefore, regarded as containing the secretory fibres for the gland. The increased secretion is independent of the vascular changes simultaneously provoked.

W. D. H.

Chemistry of the Thyroid. By Ernst Roos (*Zeit. physiol. Chem.*, 1899, **26**, 429—435).—Polemical. Critical remarks on the paper recently published by Blum (this vol., ii, 160). W. D. H.

The Microchemical Detection [Localisation] of Phosphorus in Animal and Vegetable Tissues. By A. B. Macallum (*Proc. Roy. Soc.*, 1898, **63**, 467—479).—The localisation of phosphorus in the tissue elements by microchemical means is a question of considerable importance, but the method introduced by Lilienfeld and Monti for the purpose (Abstr., 1893, ii, 135) is fallacious. The following new method is recommended. Sections of fresh tissues, after treatment with alcohol, are placed in nitromolybdate for times varying from 10 minutes to 48 hours, at 35°. The inorganic phosphates are first affected, then lecithin, then the phosphorus combined in nuclein and similar substances; the lecithin may, however, be previously removed with boiling alcohol. The sections are then placed in a reducing solution, the best for the purpose being a 1 to 4 per cent. solution of phenylhydrazine hydrochloride; this brings out a green colour where the phosphomolybdate compound occurs, but only a faint yellow reaction when ammonium molybdate alone is present. The preparations are then dehydrated, cleared, and mounted in the usual way. The results obtained with various animal and vegetable tissues are described. W. D. H.

Relation between the Growth of the Progeny and Composition of the Milk, and between the Ash of the Progeny and that of the Milk. By Emil Abderhalden (*Zeit. physiol. Chem.*, 1899, **26**, 487—497; 498—500).—The experiments were made on rabbits, cats, and dogs; numerous analytical details are given, and the results on the whole confirm Bunge's well-known views on the subject. W. D. H.

Freezing Point of Milk. By Justin Winter (*Bull. Soc. Chim.*, [iii], **17**, 999—1003. Compare Abstr., 1896, ii, 199; 1897, ii, 112 and 378).—A controversial paper in which the author reaffirms the statement that milk has a constant freezing point. T. M. L.

A New Proteid Constituent of Milk. By Augustin Wróblewski (*Zeit. physiol. Chem.*, 1898, **26**, 308—313).—A new proteid material is obtainable from milk by 'salting out' with sodium chloride, after the caseinogen has been precipitated with acetic acid. Its percentage composition is C, 45·01; H, 7·31; N, 15·07; P, 0·8; S, 4·7, and O, 27·11. After boiling with sulphuric acid, it reduces Fehling's solution; by peptic digestion, it yields no pseudonuclein; as it is neither coagulated by heat, nor precipitated by dialysis, it is neither albumin nor globulin. On account of the opalescent character of its solutions, the name *opalisin* is given to it. It is abundant in human milk, less abundant in mare's milk, and scanty in cow's milk. It is the presence of this proteid which makes the precipitation of the casein of human milk so difficult. W. D. H.

The Sugar of Diabetic Urine. By Le Goff (*Compt. rend.*, 1898, **127**, 817—819).—See this vol., i, 242.

Alloxuric Bases Present in Urine. By MARTIN KRÜGER and GEORG SALOMON (*Zeit. physiol. Chem.*, 1898, **26**, 350—380. Compare Abstr., 1895, ii, 94; 1896, ii, 200; and 1898, i, 699).—The authors now employ a different method for separating the alloxuric bases in human urine, which consists in precipitating the alloxuric compounds with ammoniacal silver solution, or with copper sulphate and sodium hydrogen sulphite, decomposing their silver or cuprous derivatives with hydrochloric acid or with hydrogen sulphide in presence of this acid, evaporating to dryness the filtrate from the inorganic precipitate, and digesting the residue with warm water; the insoluble portion now consists of the xanthine fraction, whilst the solution contains the hypoxanthine fraction, together with paraxanthine. The insoluble portion is dissolved in dilute soda, and the heteroxanthine separated by means of its sodium derivative; the solution acidified with moderately strong nitric acid yields xanthine nitrate; from the final filtrate, 1-methylxanthine is precipitated on the addition of ammonia.

On methylation, 1-methylxanthine yields successively theophylline and caffeine. *Bromo*-1-*methylxanthine*, produced by heating the base with excess of bromine at 110° for 6 hours, is obtained in aggregates of pyramids; it is not decomposed on heating to 295°.

Epiguanine is precipitated from the solution of the hypoxanthine fraction on adding ammonia; the filtrate, freed from excess of this reagent and treated with a solution of picric acid, yields adenine picrate. The bases still remaining in solution are precipitated in the form of their silver or cuprous derivatives, and the latter compounds are decomposed by hydrogen sulphide; the filtrate from the metallic sulphide, when evaporated to a small bulk and acidified with nitric acid, yields hypoxanthine nitrate. The mother liquor contains, besides paraxanthine, a certain quantity of heteroxanthine, 1-methylxanthine, and hypoxanthine, and the whole process is repeated on this fraction; from the final filtrates, paraxanthine is obtained, either as the free base or as the sodium derivative. Guanine and carnine are not found in either of the above fractions.

The authors now find that the following quantities of alloxuric bases are contained in 10,000 litres of human urine: 10·11 grams of xanthine, 22·345 grams of heteroxanthine, 31·285 grams of 1-methylxanthine, 15·31 grams of paraxanthine, 8·50 grams of hypoxanthine, 3·54 grams of adenine, and 3·40 grams of epiguanine. The bases adenine, hypoxanthine, and xanthine, due to the breaking down of nuclein, occur in smaller quantities than the homologues of xanthine, which are probably derived from the theobromine, caffeine, and theophylline introduced into the system by the use of tea and coffee, paraxanthine (1 : 7-dimethylxanthine) being obtained from caffeine (1 : 3 : 7-trimethylxanthine), heteroxanthine (7-methylxanthine) from theobromine (3 : 7-dimethylxanthine), and 1-methylxanthine from theophylline (1 : 3-dimethylxanthine) by the elimination of the labile methyl group in position 3. (Compare Abstr., 1895, i, 434.) G. T. M.

Physiological Action of Certain Derivatives of Proteids. By RUSSELL H. CHITTENDEN, LAFAYETTE B. MENDEL, and YANDELL HENDERSON (*Amer. J. Physiol.*, 1899, **2**, 142—181).—The substances investigated are various forms of albumose and peptone prepared from proteid and gelatin; the anti-albumose used was made by digesting anti-albumid. The injection of such substances into the blood stream causes a slight initial rise of arterial blood pressure, due to the momentary increase of the vascular contents; this is followed by a fall. The gelatin products cause a very small effect; so also do anti-albumid, and especially anti-peptone. The albumoses act vigorously, especially heteroalbumose.

The effect of hindering blood-coagulation does not run parallel to the preceding; the two phenomena are, therefore, independent; the order of activity in retarding coagulation is albumose, anti-albumid, peptone. Protogelatose hastens coagulation; large doses of deuterogelatose retard it; gelatin-peptone accelerates it slightly.

Experiments on immunity partly confirm Grosjean's observations, and extend them by showing that the immunity acquired to subsequent injections is by no means characteristic of the specific products injected, but due to a specific reaction produced in each case within the organism itself.

Anti-albumid, hemipeptone heteroalbumose, and deuterogelatose act as true lymphagogues. The anti-clotting substance is probably formed in the liver, and reaches the blood mainly through the lymph.

Most of the substances injected lessen the flow of urine; this is specially the case with heteroalbumose, even though the fall of blood-pressure it causes may not be marked. Anti-albumid appears to act specifically also on the kidneys, although in a less degree. Large doses of hemipeptones and the gelatoses may act as diuretics; when this occurs, the primary proteoses undergo hydrolysis, and pass into the urine as deuteroproteose.

The paper concludes with theoretical remarks on proteolytic products in view of recent work which appears to upset the old idea of Kühne on the subdivision of these products into hemi- and anti-groups.

W. D. H.

Fat in the Liver of Infants Suffering from Gastro-Enteritis. By Martin Thiemich (*Zeit. physiol. Chem.*, 1898, **26**, 189—217).—From observations on cases of gastro-enteritis in infants, some of which showed fatty livers, the conclusion is drawn that the hepatic condition is due rather to fatty infiltration than to fatty degeneration. The composition of the liver fat is markedly different from that of the fat in the food (milk); moreover, absorption of fat from the alimentary canal is at a minimum. The fat is considered to be derived from the subcutaneous tissues, but there is not a complete agreement in the composition of the fat from the two sources, the fat from the liver being richer in oleic acid, and poorer in the solid fatty acids.

W. D. H.

Antagonism Between Toxins and Antitoxins. By Charles James Martin and Thomas Cherry (*Proc. Roy. Soc.*, 1898, **63**, 420—432).—Behring maintains that the antagonism between toxins and antitoxins is a chemical one, whilst Buchner and others consider that the interaction takes place only through the intervention of the cells of the organism. The present paper describes experiments which strongly support the former view. The toxins and antitoxins used were those of snake venom and of diphtheria. The principal experiments which support the second view are those of Calmette, who found that cobra poison is not destroyed by heating its solutions to 68° for 10 minutes, but that antitoxin is completely destroyed; a mixture of the venom and antivenin produces no symptoms when injected into animals, but if the two substances had remained in contact for 10 minutes, and were then heated to 68° for 10 minutes before injection, death ensued. He therefore concludes that the two substances do not interact *in vitro*.

The present experiments show that the fact recorded by Calmette is quite true, but if the two substances remain in contact for more than 10 minutes in the test-tube, the interaction does take place, and subsequent injection after heating is innocuous. Calmette did not sufficiently heed the value of the factor time; in the case of heavy molecules like those of toxin and antitoxin, the velocity coefficient is a high one.

From experiments on filtration through gelatin films, the conclusion is drawn that the antitoxin molecule is the heavier of the two; it will not pass through a gelatin filter, whereas the toxin will. This confirms previous experiments made by Brodie; the toxin is an albumose, the antitoxin a globulin, or at least their molecules stand on about the same level. In a mixture of the two substances, the toxin can be separated by the use of such a filter, but if the two substances are allowed to remain in contact for a sufficient time before filtration, the filtrate is free from toxin. The proof that the two substances do neutralise each other *in vitro* is thus most complete. W. D. H.

Analogies between the Physiological Effects of High Temperature, Lack of Oxygen, and Certain Poisons. By WILLIAM D. ZOETHOUT (*Amer. J. Physiol*, 1899, **2**, 220—242).—Alkalis in very small percentage ($\frac{1}{400}$—$\frac{1}{2000}$ per cent.) increase the resistance of *Paramœcia* to heat (36—40°), to the lack of oxygen, and to the destructive action of potassium cyanide and atropine. Acids on the other hand, never increase, but when at all active always decrease the power of resistance to the agents named. The explanation advanced is that the lack of oxygen (produced by hydrogen atmosphere, or by poisons preventing oxidation) and high temperature cause the formation of certain substances which render the transformation of chemical into molecular energy impossible, thereby producing death. These substances are in some way antagonised by alkalis but not by acids. W. D. H.

Acetonuria in Phloridzin Poisoning. By H. CHR. GEELMUYDEN (*Zeit. physiol. Chem.*, 1898, **26**, 381—389).—In starving dogs, phloridzin causes both glycosuria and acetonuria, but the acetonuria is insignificant if the animal has been fed on food containing proteids or carbohydrates, a carbohydrate diet especially hindering acetonuria, but with very large doses of phloridzin, acetonuria appears, in spite of the diet. Two experiments on fat-feeding showed in one case a disappearance of the acetonuria, in the other an increase. Butyric acid, in doses of 2 grams, given by the stomach, increases the acetonuria, but when it is subcutaneously injected, the effect is very slight. Butyric acid has not this effect if phloridzin is not given as well.

W. D. H.

Chemistry of Vegetable Physiology and Agriculture.

Alcoholic Fermentation without Yeast Cells. VIII. By EDUARD BUCHNER and RUDOLF RAPP (*Ber.*, 1899, **32**, 127—137. Compare Abstr., 1897, ii, 154 and 380, and 1898, ii, 127, 246, 346, 396, and 480).—In order to ascertain whether the fermenting action of yeast-extract is due to a soluble enzyme or to particles of living protoplasm, the authors have made use of a centrifugal machine, and find that, after 2 to 5 hours, no difference can be detected in the fermenting power of the upper and lower layers of the extract. They also show that the fermentation is not hindered by the addition of large quantities of glycerol to the extract. Although this would suffice to kill any living organisms that might be present, the fermenting power of yeast cells under similar conditions was found to agree closely with that of the extract when the quantity taken was such as would contain an equal weight of nitrogen. Desiccated yeast-extract was found to be unaltered after 2 months, but had a lower fermenting power when kept for 7 or 8 months; it was not changed by heating at 85° for 8 hours, but its action on cane sugar was almost entirely destroyed by heating at 97° during 6 hours.

The latter part of the paper is in answer to Abeles (Abstr., 1898, ii, 621), who regards the fermentation as due to living protoplasm in the extract.

T. M. L.

Formation of Glycogen in Yeast. By E. KAYSER and E. BOULLANGER (*Chem. Centr.*, 1898, ii, 440—441; from *Ann. Brass. et Dist.*, 1898).—The authors have cultivated wine-yeast in solutions of cane- or grape-sugar and then determined the amount of glycogen formed, by counting the number of cells which are coloured reddish-brown or yellow by iodine solution. Both kinds of sugar appear to yield glycogen with equal facility. In weak sugar solutions, the glycogen disappears quickly, whilst solutions containing 10—15 per cent. of sugar do not suffer loss even on long exposure to the air. When cultivations are made in open dishes, less glycogen is formed, and it disappears more quickly, especially in weak solutions, than when the surface exposed to the air is limited by employing narrow tubes. With a 20 per cent. solution, the glycogen is formed very slowly, as at first the cells only multiply very gradually, but after a time 80 per cent. of the cells give a reddish-brown coloration with iodine.

The authors have also determined the influence of tartaric, malic, and citric acids on the production of glycogen; the smaller the quantity of acid present, the greater the quantity of glycogen formed and the more slowly it disappears. Tartaric acid is the most effective in preventing the formation of glycogen, but the nature of the yeast and the temperature of the fermentation have a great influence. Acetic acid does not exert any preventive action, and acts like alcohol in preserving the glycogen, the yeast possibly deriving its nutriment from the acid on converting it into glycogen. When peptone is used in the cultivations, less volatile acids are formed, and the glycogen appears and disappears more quickly. The formation of glycogen also depends on the amount of sugar present, the temperature, the quantity of nitrogen in the nutritive material, and on the conditions of access to the air. E. W. W.

Chemistry of Tubercle Bacilli. By W. G. Ruppel (*Zeit. physiol. Chem.*, 1898, **26**, 218—232).—About 18 to 20 per cent. of the tubercle bacilli (obtained in mass, and extracted by methods given in full detail) consists of proteose-like substances, in the main analogous to the atmid-albumoses of Neumeister. There is also an insoluble substance, which is often abundant, and appears to be characteristic, and probably is the active substance in tuberculin. It contains 9·42 per cent. of phosphorus; its exact nature is at present uncertain. The name 'tuberculic acid' is suggested. W. D. H.

Assimilation of Oxidised and Amidic Nitrogen by the Higher Plants. By Mazé (*Compt. rend.*, 1898, **127**, 1031—1033).—A series of comparative experiments, made on the relative influence of nitrates and ammonium salts, on the germination of the seeds of maize, bean, and vetch plants in sterilised nutritive solutions, and in aqueous solutions containing only the nitrogenous salts, indicate that ammonium sulphate and sodium nitrate are equally favourable to the growth of the plant, and that ammonia is absorbed as such, for no trace of nitrates or nitrites could be detected in the solutions containing the ammonium salt at the conclusion of the experiment. G. T. M.

Nitrogen Nutrition of Plants. By L. Richter (*Landw. Versuchs-Stat.*, 1898, **51**, 220—241).—Peas, buckwheat, oats, and mustard were grown in pots containing a mixture of sand (3600) and soil (1200 grams) containing 4·584 grams of nitrogen per pot. There were 15 pots to each plant, and the conditions were as follows. *A*, (pots 1—4) not sterilised and inoculated; *B.a*, (5—8) sterilised and inoculated; *B.b*, sterilised, inoculated, and again sterilised after each crop; *B.c*, same as *B.b*, but not inoculated. From pots 4, 8, and 15, one crop was obtained; from pots 7, 11, and 14, two crops, and from the rest, three crops in the same season. Pots 1, 5, and 9 received 0·5 gram of nitrogen as nitrate after the first and second crops.

The peas alone were able to utilise the free nitrogen of the air and give good second and third crops, whilst the produce of the other plants diminished as the supply of nitrogen in the soil became less. In each case, the soil which was not sterilised, and which received no nitrate, showed a gain of nitrogen; where nitrate was added, there was a loss of nitrogen in the soil. Nitrogen fixation in the soil seems, therefore, only to take place when the amount of assimilable nitrogen begins to fail. Most of the sterilised pots showed a loss of nitrogen, due, probably, to the manurial effect of the available nitrogen liberated in the process of sterilising by heat.

In 1895, similar experiments were made with oats. In addition to the nitrate pots, there were also pots manured with the same amount of nitrogen in the form of asparagine. The results confirmed those previously obtained: gain of nitrogen in unsterilised soil in which the available nitrogen has been used up; loss of nitrogen in presence of readily assimilable nitrogen compounds. The loss in fallow pots manured with asparagine was, however, very slight as compared with the nitrate pots. There is no conclusive evidence to show whether the loss of nitrogen is due to micro-organisms. The losses of nitrogen in the sterilised pots diminished towards the end of the experiment, and in some cases there was finally a gain; this is explained on the assumption that the available nitrogen became exhausted and the soil was thus reduced to the condition in which fixation of nitrogen takes place. N. H. J. M.

Selective Absorption of Certain Elements by Plants. By E. Demoussy (*Compt. rend.*, 1898, **127**, 970—972. Compare *ibid.*, 771).—In the experiments now described, the plants were grown in different solutions, each containing two salts. *Potassium nitrate and chloride.*—Buckwheat was grown in a solution containing 1½ mols. of each salt in milligrams per 100 c.c. After 5 days, the analysis of the solution showed that 6·5 milligrams of nitric acid and only 2·7 milligrams of chlorine had been absorbed, that is to say, 31 per cent. of the nitrogen and 5 per cent. of the chlorine had been assimilated. Colza gave similar results. *Potassium and calcium.*—In a solution containing K, 84, and Ca, 42 milligrams, wheat absorbed in 4 days, K, 57·4, and Ca, 13 milligrams, or 68·3 and 30·7 per cent. respectively. Similar results were obtained with rye, peas, colza, and lentils. *Sodium and calcium.*—Colza absorbed rather less calcium than sodium, maize rather more. *Potassium and sodium.*—Colza absorbed 40 miligrams of potassium, but no sodium; rye absorbed a very small amount of sodium, and 22 times as much potassium. In presence of potassium, the absorption of sodium is greatly diminished, or even completely prevented.

In the case of solutions containing one substance, the substance is absorbed by the plant if not injurious, but certain injurious substances are absorbed only in small amounts. With complex solutions, the plant exercises a selective power.

In all the experiments, very young plants were employed.

N. H. J. M.

Researches on the Vegetation of Certain Algæ. By Raoul Bouilhac (*Ann. Agron.*, 1898, **24**, 561—602).—The investigation included (1) effect of arsenic acid on the growth of algæ, (2) fixation of atmospheric nitrogen by bacteria associated with algæ, and (3) cultivation of green algæ in presence of organic matter, both with and without access of light. Many algæ were found to vegetate in solutions containing potassium arsenite; some are benefited by it, and in some cases arsenates may partially take the place of phosphates.

Schizothrix lardacea, *Ulothrix flaccida*, and *Nostoc punctiforme* are alone unable to develop in non-nitrogeneous solutions. In presence of soil bacteria, however, *Nostoc* utilises atmospheric nitrogen and develops normally. On exposure to light, normal growth, accompanied by fixation of nitrogen, is obtained in entire absence of organic matter. In dilute solutions of glucose, *Nostoc* grows rapidly when soil bacteria are present, the yield being increased fourfold as compared with the growth obtained in purely mineral solutions.

Without, or with, insufficient light, *Nostoc* only grows in presence of organic matter such as glucose. With a temperature of 30°, it may be grown in glucose solutions in absolute darkness, retaining its green colour; the green colouring matter was shown by its spectrum to be chlorophyll (compare this vol., ii, 46). The amount of glucose must not exceed 1 per cent., as *Nostoc* is unable to live in stronger solutions.

N. H. J. M.

Influence of Anæsthetics on the Formation of Chlorophyll by Plants. By E. C. Téodoresco and Henri Coupin (*Compt. rend.*, 1898, **127**, 884—887).—Bernard suggested that anæsthetics influence plants by preventing the assimilation of carbon; the authors now find that chloroform and ether prevent the formation of chlorophyll in etiolated plants exposed to diffused sunlight. In the experiments described, the anæsthetic (0·8—5·5 c.c.) was vaporised beneath glass shades which were sufficiently large not to interfere with the respiratory exchange of gases of the plants grown beneath them; the influence of the anæsthetic was determined by comparing the plants with those grown in the open air under conditions otherwise similar. The plants studied were wheat, vetch, white lupin, and buckwheat, and the formation of chlorophyll was observed during periods ranging from 5 to 24 hours. The quantity of the same anæsthetic necessary to produce the maximum retardation in the production of chlorophyll varies, although between somewhat narrow limits, for different plants; if an excess be employed, the plant sickens and dies. If less of the anæsthetic be employed than that corresponding with complete cessation of chlorophyll formation, the etiolated plants slowly become green, although marked retardation in comparison with the control plants is observed.

W. A. D.

Digestion of Starch in Plants. By Leclerc du Sablon (*Compt. rend.*, 1898, **127**, 968—970).—The author has investigated the digestion of starch in certain bulbs and tubers by the diastases present in the plants themselves during the digestion of the reserve materials. With a view to accelerate this action, the organs were in some cases crushed in presence of water and the increased rate of digestion observed. In this way, he has found that in the lily, tulip, hyacinth, arum, ficaire, and colchicum the starch is converted into dextrin, and as digestion proceeds a sugar is formed that seems to be a saccharose with a lower reducing power than maltose, and may be different in different plants. At a still later stage, part at least of the sugar is converted into glucose. In the onion and the asphodel, the saccharose is gradually converted into glucose. It follows that the diastatic digestion of starch in living plants does not stop at the formation of a saccharose, but continues until the starch has been directly converted into assimilable glucose. C. H. B.

Decomposition of Proteids in Plants. By ERNST SCHULZE (*Zeit. physiol. Chem.*, 1899, **26**, 411—426. Compare Abstr., 1898, ii, 481).—The research amplifies the author's previous statements as to the importance of the formation of asparagine and glutamine in plants. W. D. H.

Nitrogenous Materials in Fungi. By ERNST WINTERSTEIN (*Zeit. physiol. Chem.*, 1899, **26**, 438—441).—Fungi differ from flowering plants in several chemical points Among the nitrogenous compounds present are large amounts of proteid; leucine and tyrosine were also isolated in a crystalline state. W. D. H.

An Active Principle in Millet Hay. By E. F. LADD (*Amer. Chem. J.*, 1898, **20**, 861—866).—The exclusive feeding of horses on millet hay (*Setaria Italica*) causes a diseased condition, characterised by a very much increased urination. On macerating well-pulverised millet with alcohol during 8 days, 6·25 per cent. of organic matter is extracted; on evaporating the extract and dissolving the residue in water, a bitter solution is formed which gives no precipitate with copper acetate, and is, therefore, free from tannins. On acidifying the solution, and subsequently extracting with benzene and evaporating, a pale yellow liquid is obtained which solidifies when cooled below the ordinary temperature; it becomes brown on adding concentrated sulphuric acid, yellow in presence of nitric acid, and gives a green precipitate with Frohde's reagent. With phenol, it produces a reddish-brown coloration, and with cane sugar and sulphuric acid, a violet, whilst with lead acetate solution a white precipitate is formed. Although not acted on by alkalis, it is decomposed by sulphuric acid, yielding a sugar which reduces Fehling's solution; it thus appears to consist of a glucoside, and in some respects resembles daphnin. Like the latter, it possesses marked physiological action; the aqueous solution, administered to mice and rats, produces stupefaction after 2 hours, accompanied by very frequent urination. Hypodermic injections produce the same effect, but much more rapidly. W. A. D.

Occurrence of Hydrocyanic Acid in the Prunaceæ. By A. J. VAN DER VEN (*Chem. Centr.*, 1898, ii, 678; from *Ned. Tijdsch. Pharm.*, **10**, 239—241).—The presence of hydrocyanic acid is detected by the formation of Prussian blue when the extract, obtained by treating the plant with a 5 per cent. solution of sodium hydroxide in alcohol, is poured into a mixture of ferric chloride and ferrous sulphate dissolved in water, and hydrochloric acid then added. The branches of *Prunus laurocerasus* contain 0·05 per cent. in the sieve tubes, the young green twigs yielding the most. The tap-root gives a stronger reaction than the rootlets. The acid is distributed over the whole surface of the old leaves, which contain 0·117—0·101 per cent., whilst those of the previous year have a much smaller content. In the youngest leaves, just unfolded, the acid occurs only in isolated groups of cells along the nerves, and the amount sometimes reaches 0·24 per cent. By keeping the plant in the dark, the amount of acid decreases, and in some plants it entirely disappears. E. W. W.

Estimation of Tannin in the Oak Barks of the Canton of Geneva. By WILLIAM BOREL and H. W. DE BLONAY (*Chem. Centr.*, 1898, ii, 796—797; from *Arch. Sci. Phys. Nat. Geneva*, [iv], **6**, 160—168).—The object of the investigation was to ascertain the influence of age and of the barking process on the yield of tannin in oak-bark.

The barks were obtained from stems of *Quercus pedunculata* grown on a 430 m. high terrace on "glacier clay soil." The samples were all taken by cutting a ring from the tree at 1 m. distance from the bottom. The analyses were performed by the process recommended by Jean, namely, titration with iodine before and after treatment of the infusion with hide powder. The table shows the influence of age on the percentage of tannin.

5	20	25	32	41	50	51 years.
8·40	7·15	6·60	5·35	5·05	5·00	5·90 per cent.

The smaller percentage of tannin contained in barks from old trees is, however, more than compensated for by the superior yield of bark. The barking process does not influence the amount of tannin, but it causes an increase in the yield of bark of from 25—40 per cent.

L. DE K.

Constituents of the Seeds of Picea excelsa. Products of the Decomposition of the Proteids of the Seeds. By N. RONGGER (*Landw. Versuchs.-Stat.*, 1898, **51**, 89—116).—The percentage composition of the seeds was found to be as follows.

					N-free subst.				
Proteids.	Nuclein, &c.	Glycerides.	Cholesterol.	Lecithin.	soluble.	insol.	Crude fibre.	Ash.	Not determined.
15·89	3·23	35·13	(0·06)	0·12	5·43	7·00	25·40	4·74	3·00

The amount given as proteids was obtained by multiplying the nitrogen by 5·5; that given as nuclein (including other undigestible nitrogen compounds) by multiplying the nitrogen by 7·7. Under glycerides, free fatty acids are included. The sugars present are cane sugar and an amorphous sugar; the latter dissolves readily in water, and after being heated with dilute hydrogen chloride, reduces Fehling's solution. It gives the levulose reaction when heated with resorcinol and hydrochloric acid, and when heated with dilute nitric acid yields mucic acid. $[\alpha]_D = +105·4°$. The carbohydrate resembles raffinose, but it yielded more mucic acid than the latter, and is, moreover, not crystalline. The seeds do not contain starch.

The proteids of the seeds, when boiled with hydrochloric acid and stannous chloride, yielded 10·3 per cent. of arginine, and, without doubt, other bases; leucine and tyrosine were also found. The production of so great an amount of arginine is of interest as bearing on the fact that considerable quantities of the substance are found in the young plants from the same seeds, the amount produced being four times the maximum amount obtained by Hedin from proteids of various origin. The results indicate that the proteids from different sources must be differently constituted.

N. H. J. M.

Constituents of the Seeds of Pinus Cembra. By ERNST SCHULZE and N. RONGGER (*Landw. Versuchs.-Stat.*, 1898, **51**, 189—204).—The percentage composition of the whole seeds (1), the husks (2), and the kernels (3) is as follows.

	Proteids N × 6.	Glycerides, &c.	Cholesterol.	Lecithin.	Starch.	N-free substance soluble in H_2O.	Crude fibre.	Ash.	Not determined.
1.	6·54	14·50	0·03	0·37	2·78	6·24	46·00	1·60	22·0
2.	0·84	1·18	—	—	—	98·18		0·80	—
3.	17·24	49·26	—	0·99	7·43	16·84	1·19	3·05	4·0

The large amount of substances not determined in the seeds is due to the fact that the husks form more than 60 per cent. of the whole seed. The ether extract of the husks (given under glycerides) is solid at the ordinary temperature, dissolves readily in hot alcohol, and probably contains only a small amount of glycerides. As regards the kernels, it may be assumed that the non-nitrogenous substances soluble in water consist mainly of carbohydrates (cane sugar, &c.), and that they do not include much organic acids, &c. The ash of the kernels is rich in phosphoric acid. N. H. J. M.

Toxicity of Chromium Compounds with respect to Higher Plants. By HENRI COUPIN (*Compt. rend.*, 1898, **127**, 977—978).—Water culture experiments with wheat, in which different amounts of chromium compounds were added to the solutions, gave the following toxic equivalents, the minimum toxic amounts, per cent.

$K_2Cr_2(SO_4)_2$.	$Cr_2(SO_4)_3$.	CrO_3.	K_2CrO_4.	$K_2Cr_2O_7$.	Na_2CrO_4.
1·142	0·5	0·00595	0·0625	0·03125	0·125
$Na_2Cr_2O_7$.	Am_2CrO_4.	$Am_2Cr_2O_7$.			
0·0064	0·0625	0·025			

The greatest effect is thus produced by chromium in the form of chromic acid, whether free or combined. Alkali dichromates are distinctly less active than the corresponding chromates.

N. H. J. M.

Employment of Alinite in the Cultivation of Cereals. By L. MALPEAUX (*Ann. Agron.*, 1898, **24**, 482—490).—Experiments were made in pots holding about 20 litres, two pots being, in each case, inoculated with the preparation containing *Bacillus Ellenbachensis*, known as alinite, and two being without inoculation. The following average amounts (in grams) were obtained.

	Garden soil.				Forest soil.				Sand.			
	Without alinite.		With alinite.		Without alinite.		With alinite.		Without alinite.		With alinite.	
	grain.	straw.	grain.	straw.	grain.	straw.	grain.	straw.	grain.	straw.	grain.	straw
Wheat	11	28	14	33	8	24	11	27	5	14	5	15
Barley	11	26	14	34	9	18	11	24	6	12	5	12
Oats	12	38	18	44	11	34	13	34	6	18	6	18

There was, therefore, no increased produce in sand inoculated with alinite, but in soil containing plenty of organic matter, inoculation was beneficial, owing probably to the destruction of the organic matter. Further experiments, in the field, showed no marked effect when alinite was employed; probably the soil already contained nitrogen-fixing bacteria in sufficient quantity. N. H. J. M.

Cultivation of Wheat and Oats at Grignon in 1898. By Pierre P. Dehérain (*Ann. Agron.*, 1898, **24**, 520—534).—Experiments (1) on the influence of the time of sowing the seed on the amount of produce and (2) with varieties of wheat are described. Good yields of wheat were obtained after clover, and the addition of nitrate was without effect. Nitrate was also without effect on wheat after well manured roots or potatoes; nitrate in conjunction with farmyard manure had, on the contrary, a very marked effect. The season was very favourable for dung, but not for nitrate.

The experiments on oats were also with different varieties.

Referring to that portion of Sir W. Crookes' Address to the British Association (1898) dealing with the question of the exhaustion of the supply of sodium nitrate, the author maintains that, by suitable irrigation of the soil, sufficient nitrate can be obtained for the largest wheat crops, and that the demand for nitrogenous manures could in this way be greatly diminished. N. H. J. M.

Utilisation by Plants of the Phosphoric Acid Dissolved by the Water of the Soil. By Th. Schlœsing, jun. (*Compt. rend.*, 1898, **127**, 820—822).—Maize was grown in pots containing 46 kilos. of sand and watered with Vanne water to which potassium nitrate and magnesium sulphate were added. The water contains, without further addition, sufficient lime and also 0·07 per million of phosphoric acid. Pot 1 received for some weeks this solution alone, afterwards the same solution with an additional 1 per million of phosphoric acid. Pot 2 was watered the whole time with the solution, with the addition of 2 per million (making 2·07 per million) of phosphoric acid, whilst pot 3 received no further quantity of phosphoric acid. The phosphoric acid was determined in the drainage from time to time, and, at the end of the experiment, in the produce. For some time, when the growth was still limited, the drainage water of pots 1 and 3 contained more phosphoric acid than the water applied, although the sand was very poor in phosphoric acid (23·5 per million); in the case of pot 2, the solution gave up a portion of its phosphoric acid to the soil. As the vegetation increased, the phosphoric acid of the drainage diminished considerably, especially in pot 2, in which the plants absorbed almost the whole of the phosphoric acid supplied. The yield of produce (dried at 40°) was, pot 1, 152; pot 2, 621, and pot 3, 53 grams (2 plants each pot). With wheat watered with solutions containing 0·5 and 1·0 per million of phosphoric acid, yields were obtained corresponding with 10 and 18 hectolitres per hectare. N. H. J. M.

Effect, on Vegetation, of Perchlorate present in Potassium Nitrate. By Aimé Pagnoul (*Ann. Agron.*, 1898, **24**, 607—608; from *J. Agric. Prat.*, 1898, ii, 159).—Two per cent. of potassium perchlorate in potassium nitrate had comparatively little effect on the growth of fescue, but larger amounts almost killed the plants. The quantity which is normally present in the ordinary nitrates used as manures, is therefore unimportant. N. H. J. M.

Analytical Chemistry.

Colorimetric Estimation of Oxygen dissolved in Water. By William McD. Mackey and R. E. Middleton (*J. Soc. Chem. Ind.*, 1898, **17**, 1127—1128).—Two U-tubes, each of 265 c.c. capacity, are employed. One is graduated, the other plain. Each limb is surmounted by a stopcock and funnel head, and near the bend there is a side tube with a stopcock. The ungraduated tube is filled with the water to be examined. About 5 c.c. of coal gas is introduced by the side tube, and then 5 c.c. of a 15 per cent. solution of potash is added through one funnel, and 5 c.c. of a 5 per cent. solution of pyrogallol through the other, the displaced water being drawn off at the side tube. The bubble of gas is used to mix the contents of the two limbs, and in 10—20 minutes the maximum depth of the brown coloration, due to oxygen present, is attained. Another portion of the same water is diluted with distilled water, boiled down to its original bulk to free it from oxygen, and cooled in coal gas in a flask fitted with two tubes like a wash bottle. By passing coal gas through these tubes and inverting the flask, the water is transferred to the graduated U-tube, through the side stopcock. Pyrogallol and potash are added as before, and then air is drawn in until, after agitation, the depth of colour is the same as in the other apparatus. The residual nitrogen is then transferred to one of the limbs, and its volume read off after lowering the water in the other limb to the same level. The brown coloration is fairly permanent in the absence of light, so that the reagents may be added to the water as soon as it has been collected and the comparison made in the laboratory later. As the volume of the water is in each case approximately 250 c.c. (265—15), the volume of the nitrogen gives at once cubic centimetres of oxygen per litre. M. J. S.

Separation and Estimation of the Halogens in their Silver Compounds. By Henri Baubigny (*Compt. rend.*, 1898, **127**, 1219—1221).—Neutral solutions of potassium permanganate have no action on the halogen compounds of silver. In presence of nitric acid (sp. gr. = 1·34), however, the iodide is converted into iodate, which dissolves without loss of iodine, the bromide is decomposed, yielding free bromine and bromic acid in the cold, but at 80° the whole of the bromine is liberated; the chloride is only affected when heat is applied, chlorine being then set free. The permanganic acid, however, is destroyed under these conditions before the above reactions are completed.

When the permanganate is replaced by chromate, the iodide is readily converted into iodate, but the chloride and bromide are only slowly attacked even at 100°. If, in addition, sulphuric acid (64—65° B.) instead of nitric acid be used, the iodide is quantitatively converted into iodate, and the bromine and chlorine are set free at a temperature of 90—95°. The following method of separating the halogen is based on this fact.

The halogens are precipitated as silver compounds, which are separated by filtration through glass wool contained in a very thin tube, which is drawn out to a fine point at one end; the tube is transferred to a flask and broken by agitation, the cold chromic acid mixture is then added and the whole heated at 90—95°, the chlorine and bromine liberated being collected by aspiration through bulbs containing alkali; the iodate formed is reduced by means of sulphurous anhydride passed into the diluted and filtered liquid, when silver iodide is precipitated in quantitative amount. If the silver iodide has a grey tint, due to the presence of reduced silver, it is only necessary to boil it for a short time with nitric acid in order to eliminate this source of error.

In some cases, when water is added to the cold chromic acid mixture, precipitation of silver chromate occurs, hence it is advisable to avoid the use of any large excess of dichromate. In case any such precipitate is formed, it should be dissolved in ammonia and reduced by means of sulphurous anhydride, any silver iodide produced being added to that obtained in the ordinary course of the experiment.

A. L.

Estimation of Perchlorate in Chili Salpetre. By C. Ahrens and P. Hett (*Chem. Centr.*, 1898, ii, 558; from *Zeit. öffentl. Chem.*, **4**, 445—448).—Twenty grams of the powdered sample is introduced into a flat 200 c.c. platinum dish, moistened with 2—3 c.c. of cold saturated aqueous soda, 1 gram of pure manganese dioxide added, and the whole evaporated to dryness; the dish is then covered and heated to redness over a Maste burner. When cold, the fused mass is treated with 100 c.c. of hot water, allowed to cool, and then made up to 250 c.c.; 50 c.c. of the filtrate is acidified with 10—15 c.c. of nitric acid of sp. gr. = 1·20, and a 1 per cent. solution of potassium permanganate is added drop by drop until the colour is permanent for a minute, showing that all the nitrous acid has been oxidised. The chlorine is then estimated by Volhard's process, and the difference between the amounts of chlorine found before and after fusion is calculated into perchlorate. Iodides present in the sample do not interfere, as they are oxidised to iodates by the permanganate. L. de K.

Estimation of Iodine in Bismuthic Iodides. By O. Spindler *Chem. Centr.*, 1898, ii, 941; from *Schweiz. Wochschr. Pharm.*, **36**, 421—423).—A weighed portion of the air-dried substance is put into a small separating funnel, a little water is added, and then sufficient ferric chloride to effect solution; the liberated iodine is dissolved by adding 3—5 c.c. of chloroform, and the extraction repeated until the chloroform remains colourless. The united liquids are collected in a glass-stoppered bottle containing some water; more water is added without shaking and then poured off, to wash the chloroform, this operation being repeated until the water runs off clear and is free from iron or bismuth oxychloride. Twenty c.c. of water and some potassium iodide are then added, and the iodine titrated, as usual, with *N*/10 sodium thiosulphate. The author states that the compounds BiI_3 and BiOI can only be obtained pure by working under specified conditions; as a rule, mixtures of these salts are obtained.

L. DE K.

Estimation of Hydrogen Sulphide, Sulphurous Acid, and Thiosulphuric Acid. By WALTHER FELD (*Chem. Centr.*, 1898, ii, 868—870; from *Chem. Ind.*, 21, 372—380).—*a. Estimation of Sulphides.*—The apparatus consists of an Erlenmeyer flask of 300—350 c.c. capacity, the doubly perforated rubber cork of which is fitted with a stopcock funnel tube reaching to the bottom of the flask, and connected at the top with the delivery tube of a carbonic anhydride apparatus. There is also a delivery tube connected with a series of four Geissler's potash bulbs and an aspirator. Of these, the first set of bulbs is empty, the second and third are filled with *N*/10 solution of iodine, and the fourth contains *N*/10 sodium thiosulphate. The aspirator regulates the current of carbonic anhydride. After the apparatus has been freed from air by a current of carbonic anhydride, the solution containing the sulphide is introduced into the flask, 20 c.c. of a 25 per cent. solution of magnesium chloride is added, and the liquid is boiled, the gas being passed meanwhile. All the sulphur is now expelled as hydrogen sulphide, which is absorbed in the bulbs and titrated in the usual way.

b. Estimation of Sulphurous Anhydride.—The same apparatus is used, the decomposition being effected with dilute hydrochloric acid.

c. Estimation of Thiosulphates.—The salt is first converted into the tetrathionate by means of iodine, and the solution is then reduced in the apparatus by means of hydrochloric acid and sheet aluminium. All the sulphur is thus given off as hydrogen sulphide.

d. Estimation of Thiosulphates in the Presence of Sulphites.—The mixture is first oxidised with iodine, and the thiosulphate is then found by estimating the amount of hydrogen sulphide given off by the acid aluminium treatment.

e. Estimation of Sulphites in the Presence of Thiosulphates.—The mixture is treated with mercuric chloride and then with hydrochloric acid; the sulphurous anhydride evolved is absorbed by the iodine and found by titration. A precipitate consisting of mercuric sulphide, due to the thiosulphate, remains in the flask unaffected by the acid.

f. Estimation of Sulphides, Sulphites, and Thiosulphates in the Presence of each other.—The sulphide is estimated by the process *a*; mercuric chloride is then added as in *e*, and the residue in the flask, after being oxidised with iodine, is treated with aluminium as in *c*.

g. Estimation of Sulphides of Alkalis or Earthy Metals, Polysulphides, Sulphites, and Thiosulphates in the Presence of Free Sulphur and Metallic Sulphides.—1. *Free Sulphur.* This is easily extracted by means of carbon bisulphide. 2. *Sulphides.* Their hydrogen sulphide is readily estimated according to the directions given in *a*. 3. *Polysulphides.* The liberated sulphur may be recovered by agitating the liquid in the flask with carbon bisulphide; a fraction of the sulphur may have combined with the sulphite to form thiosulphate. 4. *Ferrous Sulphide.* The residue from 3 is oxidised with iodine, and the liberated sulphur again extracted with carbon bisulphide. 5. *Thiosulphate.* The residue from 4, or another portion of the original liquid, is oxidised with iodine and then treated according to *c*; in the presence of polysulphides, the result will be too high. 6. *Sulphites.* These cannot be present in a solution of polysulphides, but the mixture may occur in a solid mass; this is then placed in a solution of mercuric chloride, and the unaffected sulphite decomposed as directed in *e*. L. DE K.

Volumetric Estimation of Combined Sulphuric Acid. By FÉLIX MARBOUTIN and MARCEL MOLINIÉ (*Bull. Soc. Chim.*, 1897, [iii], **17**, 950—952).—The method employed by Windish for the estimation of sulphuric acid requires the use of exactly equivalent solutions of barium chloride and potassium chromate. The authors give an account of a method by which the required correction may be accurately determined when this condition is not fulfilled. A. L.

Volumetric Method for the Estimation of Combined Sulphuric Acid. By FÉLIX MARBOUTIN (*Bull. Soc. Chim.*, 1897, [iii], **17**, 953—955).—The sulphuric acid is precipitated by means of excess of barium chloride in acid solution, the remaining barium being then precipitated by excess of chromate in neutral or faintly alkaline solution; the residual chromate is then determined by means of arsenious acid and iodine in the usual manner. A blank experiment is made in which the same volumes of barium chromate and arsenic solutions are used, when the difference in volume of the iodine solution required in the two experiments represents the amount of sulphuric acid present in the first experiment. The advantage of the method lies in the fact that no washings or filtrations are necessary, and the iodine solution is the only one which need be accurately standardised.

A. L.

Estimation of Sulphuric Acid in the Presence of Iron. By FRIEDRICH W. KÜSTER and A. THIEL (*Zeit. anorg. Chem.*, 1898, **19**, 97—103).—When a solution of sulphuric acid containing ferric chloride is precipitated with barium chloride, the precipitate contains ferric sulphate, and the results obtained are too low, and vary according to the amount of ferric chloride which is present. Accurate results can, however, be obtained either by precipitating the iron with ammonia, or by converting the iron into a complex salt, which does not come down with the barium sulphate.

The solution of sulphuric acid and ferric chloride is precipitated in the cold with a slight excess of ammonia, the mixture heated to near the boiling point, and precipitated with barium chloride, an excess of dilute hydrochloric acid added, and, after remaining for some time in order to completely dissolve the ferric hydroxide, the clear liquor is decanted through a filter. The precipitate is washed with cold hydrochloric acid a few times, and then treated in the ordinary way. The results are accurate to about 0·07 per cent.

The second method consists in adding to the sulphuric acid solution either ammonium oxalate or ammonium tartrate, and ammonia, and precipitating with barium chloride; the precipitate being then treated with hydrochloric acid as described above, accurate results are obtained.

E. C. R.

Iodometric Experiments. By **Gunner Jörgensen** (*Zeit. anorg. Chem.*, 1898, **19**, 18—36).—Riegler's statement that sodium thiosulphate can be titrated with iodic acid has been disputed by Walker (Abstr., 1898, ii, 139). The present paper deals with some of the causes of error in this reaction. Potassium iodate, in the presence of ammonium chloride, oxidises sodium thiosulphate to tetrathionate, a small quantity of sulphate being also formed, and the solution becoming alkaline; no ammonia is, however, destroyed. Potassium iodate in the presence of ammonium chloride oxidises sodium tetrathionate to sulphate, and this reaction also takes place when potassium iodide is present. In solutions containing ammonia, potassium iodate converts sodium tetrathionate into sulphate, and probably small quantities of other oxidation products of sulphur are formed, and a very small quantity of ammonia is destroyed. Iodine in ammoniacal solutions reacts with tetrathionate in a similar manner to potassium iodate; also it converts sodium thiosulphate into a mixture of sulphate and tetrathionate with some loss of ammonia. In neutral solutions, sodium tetrathionate is oxidised by iodine to sulphate, and the solution becomes strongly acid. Sodium thiosulphate is converted into a mixture of tetrathionate and sulphate by a solution of potassium iodate containing hydrochloric acid.

From the above, it is evident that ammonia cannot be titrated by Kjeldahl's iodometric method, namely by being left in contact with excess of thiosulphate, and then estimating the excess of the latter with iodine.

E. C. R.

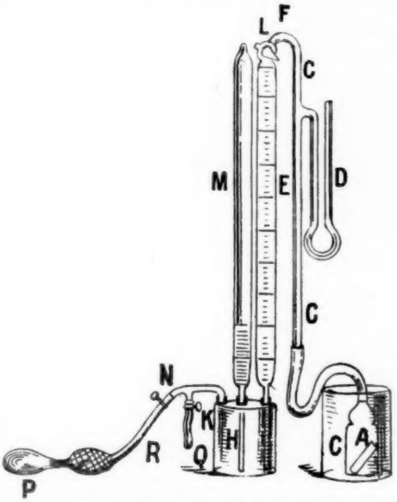
Testing Milk for Nitrates. By **Edwin Ackermann** (*Chem. Centr.*, 1898, ii, 504—505; from *Schweiz. Wochschr. Pharm.*, **36**, 285—287).—Ten c.c. of the milk is mixed with 2 drops of a 20 per cent. solution of calcium chloride, and heated, first at 50° and then for 10 minutes at 100°. The whey is then tested as follows: 0·5 c.c. is dropped slowly on to 2 c.c. of a solution of diphenylamine contained in a watch-glass, taking care not to mix the solutions. If nitrates are present, a blue ring will form after a few minutes; if not, there will be a brownish spot; the test is extremely delicate. The reagent is made by dissolving 0·02 gram of diphenylamine in 20 c.c. of dilute sulphuric acid (1 : 3), and then making up to 100 c.c. with strong sulphuric acid.

L. de K.

Reduction of Nitric Oxide by Copper, with Special Reference to Dumas' Method of Estimating Nitrogen. By **Thomas Gray** (*J. Soc. Chem. Ind.*, 1898, **17**, 741—743; 829).—Although many chemists have experienced a difficulty in reducing the nitric oxide evolved in a combustion of a nitrogenous substance by means of a heated roll of copper gauze, the author finds that a spiral 5 inches long, tightly rolled and strongly heated, will complete the reduction even when the gas is passed at a much quicker rate than is usual in such combustions. A spiral which has been used repeatedly is more efficient than a fresh one. A very high temperature is the greatest safeguard against incomplete reduction, and the current of carbonic anhydride employed to expel the air from the tube should be stopped whilst the combustion is taking place. M. J. S.

Estimation of Carbonic Anhydride in Minerals. By ARTHUR MARSHALL (*J. Soc. Chem. Ind.*, 1898, **17**, 1106—1107).—The apparatus consists of a gas generating vessel, A, a gas measuring tube, E, and a gas reduction tube, M, acting on the same principle as that in Lunge's gas volumeter, E and M dip into refined petroleum oil of high boiling point, contained in H, in which carbonic anhydride is very sparingly soluble. D is a mercury manometer, P, Q, R, N, appliances by which the pressure in H can be adjusted. The three-way stopcock L (which is imperfectly described), allows E and G to be connected, or either of them separately to be placed in communication with the external atmosphere.

Having forced the petroleum to the top of E, placed the weighed substance in A, and 1 c.c. of concentrated hydrochloric acid in the small glass tube B, A is brought to atmospheric temperature by immersing it in the water contained in C, and to atmospheric pressure by means of L; E and G are then connected, the carbonate is decomposed, keeping A in the water, by which means volatilisation of hydrochloric acid is prevented, the pressure is brought to equality with the atmosphere, and then, after closing L, it is again adjusted until the gas in M occupies the standard volume. The reading of E then gives at once the volume of carbonic anhydride at 0° and 760 mm. By using concentrated acid, the error due to carbonic anhydride remaining in solution is reduced to a minimum, and there is a small compensating error when the level of the petroleum in E is higher than that in M. M. J. S.



Action of an Alkaline Solution of Formaldehyde on Silver Haloids and Thiocyanate. By LUDWIG VANINO (*Ber.*, 1898, **31**, 3136—3139).—These silver salts can be reduced quantitatively to metallic silver by pouring caustic potash or soda over them in a porcelain dish and adding formaldehyde solution; as a rule, the reaction is complete in a few minutes. In the case of silver bromide, it is necessary to warm if the solution is dilute; in the case of silver iodide, it is necessary to boil, and to add formaldehyde repeatedly. For reducing silver chloride, aqueous potassium or sodium carbonate may be used instead of the hydroxide, the solution being warmed gently; fused silver chloride, however, is only reduced under these circumstances when powdered, and the solution should be boiled.

This method may be adopted conveniently for recovering silver from the residues obtained in the titration of that metal with thiocyanate solution; a residue of pure silver is obtained, any iron compound mixed with the original solid going into solution; the residue is simply washed with water. C. F. B.

Electrolytic Estimation of Zinc. By HEINRICH PAWECK (*Chem. Centr.*, 1898, ii, 872—873; from *Österr. Zeit. Berg-Hütt.*, **46**, 570—573).—In order to facilitate the electric separation of zinc, Vortmann has proposed to add to the solution a known weight of mercuric chloride; the zinc then separates as amalgam, and allowance is made for the amount of mercury deposited.

The author has noticed that in this process the platinum cathodes are attacked and lose in weight; the addition of mercuric chloride is also inconvenient. He now proposes using amalgamated brass wire gauze cathodes, so as to prevent hydrogen bubbles from adhering to the cathode and, consequently, the formation of spongy zinc. Two circular pieces of the gauze of 6 cm. diameter are well cleaned and covered by means of electrolysis with the mercury obtainable from 0·6 gram of mercuric chloride, washed with alcohol and ether, and dried at 30—40°. The zinc solution must contain potassium sodium tartrate and alkali; the tension should be from 2·65—3·60 volts, and the current 0·1—0·5 ampère. After gently washing and drying at 30—40°, the wire gauze is reweighed. The test analyses are satisfactory.

By using a brass wire gauze electrode, the zinc may be also deposited in a crystalline condition without amalgamation. The liquid, which must contain free acid but be free from iron, is electrolysed at 50—60°, using tensions of 3·4—3·55 volts and a current of 0·3—0·7 ampère. L. DE K.

Estimation of Lead in Lead Ores. By LEOPOLD SCHNEIDER (*Chem. Centr.*, 1898, ii, 559—560; from *Österr. Zeit. Berg-Hütt.*, **46**, 431—434).—The author recommends the following process: 1 gram of the ore (galena) is boiled in a covered 200 c.c. beaker with 5 c.c. of strong hydrochloric acid for 10—15 minutes, and 5 c.c. of strong nitric acid is then added; as soon as red fumes cease to be evolved, 10 grams of tartaric acid dissolved in 25 c.c. of water is added and the heating is continued for a short time. When cold, 25 c.c. of strong ammonia is added, and the liquid heated and filtered from any undissolved siliceous matter or barium sulphate, the filter being well washed with a weak alkaline solution of ammonium tartrate; the filtrate is then diluted to about 300 c.c., 50 c.c. of dilute sulphuric acid (1:1) is added to precipitate the metal as sulphate, and this is washed with water containing 1 per cent. of sulphuric acid, dried, ignited, and weighed. To the weight obtained, 0·003 gram should be added to compensate for the slight solubility of lead sulphate.

L. DE K.

Detection of Manganese. By Dioscoride Vitali (*Chem. Centr.*, 1898, ii, 942; from *Boll. Chim. Farm.*, **37**, 545—546).—Instead of testing for manganese by the formation of permanganic acid on heating the substance with nitric acid and lead dioxide, the author prefers acting in the cold with dilute sulphuric acid and a few crystals of potassium bromate. A gradually increasing reddish-violet colour due to permanganic acid is developed. The reaction is not given by chlorates or iodates. L. de K.

Valuation of Iron and Manganese Ores. By Paul Lehnkering (*Chem. Centr.*, 1898, ii, 507—508; from *Zeit. öffentl. Chem.*, **4**, 459—464).—*Estimation of Iron in Ores.*—The quick processes usually employed are not trustworthy if the ores contain organic matter, or insoluble ferruginous silicates, or sulphides; the presence of titanium, arsenic, or copper compounds also interferes.

The following process is recommended by the author in the case of reference analyses. Five grams of the finely powdered and dried ore after being ignited in a porcelain crucible for half an hour over a Bunsen flame to destroy any organic matter, is heated in an Erlenmeyer flask with 60 c.c. of hydrochloric acid of sp. gr. = 1·19 on the water-bath for 4 hours, evaporated to dryness, the residue dissolved in hydrochloric acid, 100 c.c. of hot water added, and the insoluble matter washed with hot dilute hydrochloric acid. The residue is then dried and fused in a platinum crucible with 5 grams of sodium potassium carbonate and a little nitre, and when cold, the fused mass is dissolved in hydrochloric acid and the solution evaporated with the addition of sulphuric acid. The residue, dissolved in dilute hydrochloric acid, is filtered, and the iron in the filtrate precipitated by ammonia, washed, redissolved in dilute hydrochloric acid and the solution added to the main liquid. Any arsenic or copper is now precipitated by hydrogen sulphide, the excess of the latter being removed by boiling and treating with potassium chlorate; after boiling off the chlorine, the iron is titrated, preferably by the stannous chloride-permanganate method.

Estimation of Manganese in Ores.—The author does not recommend the volumetric processes, but prefers estimating the metal as sulphide. The ore is first dried at 120°, and any matter insoluble in hydrochloric acid must always be fused with sodium potassium carbonate to recover any insoluble manganese.

Silica obtained from iron or manganese ores may be contaminated with insoluble sulphates or titanic acid; the latter may be separated by fusing with potassium hydrogen sulphate and extracting the fused mass with cold water. The mixture of silica and insoluble sulphates is then weighed and heated with sulphuric and hydrofluoric acids; the loss represents silica. L. de K.

Sources of Error in the Electrolytic Estimation of Iron. By Samuel Avery and Benton Dales (*Ber.*, 1899, **32**, 65—68).—The authors have made careful estimations of iron by the usual electrolytic methods, and have found that, in all cases, a certain amount of carbon is deposited together with the iron. When the estimation is carried out in ammonium oxalate solution (Classen), some 0·22 per cent. of the deposit consists of carbon, and a small quantity of iron still remains in solution. In citric acid solution, as much as 2 per cent. of the deposit often consists of carbon, compare Smith (*Elektro. Analyse*, 92), Nicholson and Avery (Abstr., 1896, ii, 627), Heidenreich (*ibid.*, ii, 545). When Moore's method (Abstr., 1886, 921) of depositing the iron from ammonium metaphosphate solution is employed, some 2 per cent. of carbon and phosphorus is also deposited. J. J. S.

Colorimetric Estimation of Iron. By E. EWERS (*Chem. Centr.*, 1898, ii, 605—606; from *Apoth. Zeit.*, **13**, 536—538).—The author rejects the use of potassium ferrocyanide for the colorimetric estimation of iron, but recommends using potassium thiocyanate. To oxidise traces of iron often found in waters or in the ash of wine, it is best to use a mixture of sulphuric and nitric acids instead of hydrochloric acid and potassium chlorate, as hydrochloric acid is seldom quite free from iron. Gerhard's tannin method is also strongly recommended. One hundred c.c. of the sample of water is mixed with 20 c.c. of a solution of sodium pyrophosphate (1 : 20) and 5 drops of tannin solution (1 : 20 dil. alcohol). The colour is then compared with that produced by means of a standard solution of iron (0·895 gram potassium iron alum and 2·5 grams of sodium pyrophosphate in a litre of water). If part of the iron has become oxidised and insoluble, it may be dissolved by means of a little oxalic acid and a little potassium citrate; the excess of oxalic acid must then be removed by calcium carbonate.

To estimate iron in milk, 200 c.c. of the sample is incinerated, and the ash fused with its own weight of sodium carbonate and a little potassium carbonate and nitrate; the phosphates are decomposed and rendered soluble and may be removed by hot water. The insoluble matter containing the iron is then dissolved in 10 c.c. of dilute hydrochloric acid and tested in a colorimeter with potassium thiocyanate.

L. DE K.

Volumetric Estimation of Bismuth. By O. SPINDLER (*Chem. Centr.*, 1898, ii, 584; 607—608; from *Schweiz. Wochschr. Pharm.*, **36**, 326—328; 333—335).—The nitric acid solution of the bismuth or an emulsion of basic bismuth nitrate is heated with excess of normal potash until the hydroxide has separated, and the excess of alkali is then titrated with normal hydrochloric acid, using phenolphthalein as indicator; the amount of nitric acid is thus found. A measured excess of accurately titrated 25 per cent. hydrochloric acid is now added to dissolve the precipitate, and the excess of acid is removed by means of normal potash; this causes the bismuth to separate as oxychloride. After decolorising the liquid with a drop of dilute acetic acid, the chlorine remaining in the liquid is estimated by means of standard silver nitrate. The difference between chlorine added and chlorine found represents an equivalent quantity of bismuth oxychloride. To apply the process to organic preparations of bismuth, these must be mixed with four times their weight of dry sodium carbonate, and gradually introduced into an iron crucible containing fusing nitre; the mass is first extracted with water, and the insoluble matter is dissolved in nitric acid and treated as directed.

L. DE K.

Volumetric Estimation of Gold and Platinum. By HEINRICH PETERSON (*Zeit. anorg. Chem.*, 1898, **19**, 59—66).—The method consists in treating the solution of the metallic salt with excess of potassium iodide, and then estimating the liberated iodine with a solution of sodium thiosulphate.

The solution of the platinum in the form of potassium platinic chloride is added to the potassium iodide solution, and the dark brown mixture titrated with sodium thiosulphate until a pure lemon-yellow coloration is obtained. The results are accurate, and very small quantities of platinum can be estimated by this method. The reaction takes place according to the equation $PtCl_4 + 4KI = PtI_2 + I_2 + 4KCl$.

The solution of the gold either as auric chloride or sodium aurichloride is treated in a similar manner, but starch solution is used as an indicator, and the dark green mixture is titrated with sodium thiosulphate until a rose coloration is obtained. The reaction takes place according to the equations: $AuCl_3 + 3KI = AuI + 2I + 3KCl$ and $AuI + Na_2S_2O_3 = NaI + NaAuS_2O_3$, therefore 3 molecules of sodium thiosulphate are required for 1 molecule of auric chloride.

E. C. R.

Estimation of Small Quantities of Methylic Alcohol, Formaldehyde, and Formic Acid. By MAURICE NICLOUX (*Bull. Soc. Chim.*, 1897, [iii], **17**, 839—840).—The author has applied his volumetric process for the estimation of alcohol (Abstr., 1898, ii, 543), based on the oxidation of the latter by a solution of potassium dichromate in sulphuric acid solution, to the estimation of small quantities of methylic alcohol, formaldehyde, and formic acid. With solutions containing up to 0·1 per cent. of these substances, and in the absence of other reducing organic compounds, the results obtained are more accurate than those given by any other process. N. L.

Indirect Estimation of Extractive Matter [in Alcoholic Beverages]. By WILHELM FRESENIUS (*Zeit. anal. Chem.*, 1899, **38**, 35—37).—In estimating the percentage of extractive matter by the Windisch or Halenke and Möslinger tables, the safer course is to calculate the gravity of the dealcoholised liquid from the original gravity and the percentage of alcohol found, instead of ascertaining the actual gravity after distilling off the alcohol, for in any case where saccharose and an organic acid are simultaneously present the inversion of the saccharose which takes place during the distillation would lead to a higher and less correct result being obtained by the latter course.

M. J. S.

Detection of Glycerol. By LEO GRÜNHUT (*Zeit. anal. Chem.*, 1899, **38**, 37—42).—On applying to some samples of chicory-coffee the methods employed for the estimation of glycerol in wine (Borgmann and W. Fresenius, *Anleitung zur Chemischen Analyse des Weines*, 2nd ed., p. 50), considerable amounts of residue were obtained, which, however, did not seem to be glycerol. An attempt to examine these "crude glycerol" residues by the permanganate oxidation method furnished in all cases small quantities of oxalic acid, but left the question open whether these were in reality derived from glycerol. The desired end was at last attained by distilling the residues with potassium hydrogen sulphate and examining the distillates for acraldehyde by treatment with a mixture of ammoniacal silver nitrate and sodium hydroxide. In none of the cases could acraldehyde be detected, although the method was proved to be a trustworthy one. There appears, therefore, to exist in chicory-coffee some substance which agrees with glycerol both as to its solubility in alcohol and ether-alcohol, and in yielding oxalic acid when oxidised by alkaline permanganate, and which, nevertheless, is not glycerol. M. J. S.

Kjeldahl's Process for Estimating Sugar. By Gustav Bruhns (*Chem. Centr.*, 1898, ii, 903—905; from *N. Zeit. Rüb.-Zucker-Ind.*, **41**, 105—112, also *Zeit. anal. Chem.*, **38**, 73—96).—The paper is devoted to a criticism of Kjeldahl's sugar process (Abstr., 1896, ii, 580).

The conclusions arrived at are as follows. 1. There is no need for operating in a current of hydrogen. 2. It is better to boil the sugar solution with the Fehling's solution for a few minutes, than to heat for 20 minutes in a water-bath. 3. It is preferable to use the Soxhlet's modification of the Fehling's solution, as it contains less alkali. 4. It is best to mix the solution of the copper sulphate with the alkaline solution of potassium sodium tartrate just before use. The cuprous oxide is best collected on a Schleicher filter instead of an asbestos filter; the amount of soluble copper retained by the paper is very trifling. 5. It has been positively proved that prolonged boiling with even pure cane sugar precipitates a large quantity of cuprous oxide, so that the Kjeldahl process gives results which are too high should cane sugar be present. L. de K.

Colorimetric Estimation of 'Invert' Sugar. By D. Sidersky (*Chem. Centr.*, 1898, ii, 648; from *Bull. Assoc. Chim.*, **15**, 1134).—The process is based on the fact that Fehling's solution is reduced, and consequently more or less decolorised, by invert sugar at the boiling temperature; the solution may then be compared in a colorimeter with the same mixture of copper solution and cane sugar which has not been boiled. From the loss of colour, the amount of copper reduced, and consequently the invert sugar, is readily calculated.

L. de K.

Detection of Cane Sugar in Milk. By Cayaux (*Chem. Centr.*, 1898, ii, 510; from *Pharm. Centr.-Halle.*, **39**, 503—504).—The author recommends the resorcinol test; 10 c.c. of the sample is boiled with 0·1 gram of resorcinol and 1 c.c. of hydrochloric acid for 5 minutes; if cane sugar is present, the liquid becomes rose red. Adulteration of milk with coco-nut juice which contains natural cane sugar may also be detected by means of the resorcinol test. L. de K.

The Most Important Sweetening Materials. By A. Gawalowski (*Zeit. anal. Chem.*, 1899, **38**, 20—30).—The author has drawn up a scheme for the employment of a small number of characteristic reagents in discriminating saccharose, dextrose, levulose, lactose, galactose, maltose, ammonium-glycyrrhizin, glycerol, and "saccharin." The reagents proposed are (*a*) Fehling's solution; (*b*) a cold saturated

solution of ammonium molybdate; (*c*) Böttger's reagent, basic bismuth nitrate and soda solution; (*d*) a solution of *a*-naphthol in dilute

Reagent.	*a.*	*b.*	*c.*		*d.*	*e.*	
			Sediment.	Upper liquid.		Upper layer.	Lower layer.
Saccharose ...	No reduction	Feebly bluish after some time	No change		Intense violet-blue	Pale yellow	Raspberry red
Dextrose	Reduction in the cold	As saccharose	Black	Yellow	No reaction	Pale yellow	Colourless
Levulose	As dextrose	Cornflower blue	As dextrose		Amber-yellow	Pale yellow	Raspberry red
Lactose	Reduction on warming	As saccharose	Feebly yellow	Intensely yellow	Deep amber-yellow	As dextrose	
Galactose......	Reduction, slowly in the cold, rapidly on heating	A somewhat deeper blue than saccharose	Grey	Colourless	No colour	Colourless	Lemon yellow
Maltose	As dextrose	No colour	Feebly brown	Intensely yellow	Deep violet	As dextrose	
Glycyrrhizin .	Reduction on boiling	No colour			No characteristic result		
Glycerol	No reduction	No reaction			Greenish after 1—2 hours		
Saccharin	No reduction	No reaction			No colour	Pale yellow	Milky white, then a greenish iridescent deposit

alcohol; (*e*) sesamé oil. Tests *b* and *c* are performed by mixing the reagent with an equal volume of a 5 per cent. solution of the substance, heating in a water-bath to 100°, and allowing to cool; *d* is applied by putting 1 c.c. of a 1 per cent. solution of the substance in a test-tube, pouring down the side 0·3 c.c. of concentrated sulphuric acid, and covering with about 1 c.c. of the naphthol solution; the colour appears in the contact zone. Test *e* is the converse of Baudouin's reaction for sesamé oil; equal volumes of the oil and hydrochloric acid, with half the volume of the saccharine substance, are vigorously shaken, then left in repose, and the colours of the two layers observed.

Besides the above reactions, the most salient physical properties of the substances, such as solubility, fermentability, optical activity, &c., are briefly described. M. J. S.

Estimation of Glycogen in Meat Extracts. By GEORG LEBBIN (*Chem. Centr.*, 1898, ii, 513; from *Pharm. Zeit.*, **43**, 519).—Twenty-five grams of extract of meat is dissolved in water, and the solution, made up to 100 c.c., is mixed with 100—150 c.c. of 90 per cent. alcohol containing 4 per cent. of potassium hydroxide; after 1—2 hours, the liquid is filtered, and the residue, after being washed with the alkaline alcohol, is dissolved in 50 c.c. of water slightly acidified with dilute hydrochloric acid, and precipitated with 10 c.c. of mercuric potassium iodide, made by dissolving 20 grams of mercuric chloride in 300 c.c. of water, adding 20 grams of potassium iodide dissolved in 100 c.c. of water, and then more mercuric chloride solution until the precipitate no longer redissolves. After half an hour, the liquid is filtered and the precipitate washed with hot water; on adding an equal bulk of 95 per cent. alcohol to the filtrate, the glycogen is precipitated, and, after being washed with alcohol and ether, is dried and weighed. L. DE K.

Detection and Estimation of Citral. By FERDINAND TIEMANN (*Ber.*, 1898, **31**, 3324—3340).—See this vol., i, 249.

Detection and Estimation of Acetone by Means of Mercuric Sulphate. By GEORGES DENIGÈS (*Compt. rend.*, 1898, **127**, 963—965).—If the product of the action of acetone on mercuric sulphate (this vol., i, 22) is dried in a vacuum or at a temperature not exceeding 100°, its composition is $(2HgSO_4,3HgO)_3,4COR_2$, and not $2HgSO_4,3HgO,COR_2$. The formation of this compound can be utilised for the detection and estimation of small quantities of acetone in water, methylic and ethylic alcohols, &c., provided that the aqueous solution does not contain more than 1 per cent., and the methylic alcohol does not contain more than 2 per cent. The reagent, prepared by dissolving 5 grams of mercuric oxide in 100 c.c. of water and 20 c.c. of sulphuric acid, must be used in large excess.

Two c.c. of the liquid and 2 c.c. of the reagent are mixed in a test-tube, and heated at 100° in a water-bath for 10 minutes; if at the end of that time there is no turbidity, no acetone is present. Even with 0·1 gram of acetone in 2 c.c., the precipitate does not form before 45 seconds. In the case of methylic alcohol, 2 c.c. are mixed with

2 c.c. of water and 4 c.c. of reagent; ethylic alcohol must be diluted until the alcoholic strength of the liquid does not exceed 2°.

For quantitative estimation, 25 c.c. of the liquid and 25 c.c. of the reagent are heated at 100° for 10 minutes in a strong closed flask of about 90 c.c. capacity, and the precipitate is collected, dried, and weighed. Another method is to dilute the liquid to 100 c.c., withdraw 20 c.c., add 15 c.c. of dilute ammonia solution (1 : 5), 10 c.c. of decinormal potassium cyanide solution, and then titrate with decinormal silver nitrate, using potassium iodide as indicator. If n = the volume of silver solution, and x = the quantity of acetone per litre of the original liquid, $x = (n - 0{\cdot}4) \times 0{\cdot}3$.

The ethylic alcohol present must not exceed 1°, and the methylic alcohol must not exceed 10°. C. H. B.

Detection of Tartaric Acid in Presence of Oxalic Acid. By Wilhelm Fresenius (*Zeit. anal. Chem.*, 1899, **38**, 33—35).—Tartaric acid cannot be separated from oxalic acid by methods based on the difference in the solubilities of the calcium salts in acetic acid. On adding calcium chloride to acetic acid solutions of the two organic acids, oxalic acid produces a precipitate instantly, tartaric acid only after some time, so that the presence of tartaric acid is no obstacle to the detection of oxalic acid; but in a mixed solution, the calcium oxalate carries down the calcium tartrate almost completely. The methods laid down in Fresenius' "Qualitative analysis" permit of the detection of both acids as well as of citric acid, when occurring together.

M. J. S.

Analysis of Mixtures of Ortho-, Meta-, and Para-nitrobenzoic Acids. By Arnold F. Holleman (*Rec. Trav. Chim.*, 1898, **17**, 335—345).—The method described is based on the difference in the solubilities of the three acids in water at 25° (this vol., i, 141); 50 c.c. of water saturated at this temperature with the ortho-acid alone is neutralised by 21·1 c.c. of $N/10$ baryta; solutions of the meta- and para-acids prepared in the same manner alone neutralise 10·0 and 1·0 c.c. of the alkali. A mixture of the ortho- and meta-acids neutralises 32·2 c.c. of the baryta, whilst mixtures of the para- with the ortho- and with the meta-acid neutralise respectively 22·1 and 11·0 c.c. (compare *loc. cit.*). The method adopted in the analysis is as follows. A weighed quantity of the mixture of acids (1—1·5 grams) is shaken in a bottle during 3 hours with 50 c.c. of water until the latter is completely saturated; 25 c.c. of the solution is then titrated against decinormal baryta, using phenolphthalein as indicator, and the remainder of the solution rapidly filtered with the aid of the pump. The residue is then extracted successively with fresh quantities of water, using 50 c.c. each time, the total amount of acid dissolved by each being determined by decinormal baryta, until the residue finally remaining consists of one of the acids only, in a pure state. This is then weighed, whilst the amount previously dissolved is calculated by taking into account its solubility in the various portions which have previously had their total acidity determined; in the case of mixtures containing both the ortho- and meta-acid, allowance must be made for their increased solubility in presence of one another. A large number of results are given indicating the accuracy of the method, and the means of applying it to mixtures containing two only or all three of the acids simultaneously.

By means of this process, the author finds that the product obtained on nitrating benzoic acid by Gerland's method (*Annalen*, 1854, **91**, 186), after being freed from sulphuric acid by washing with water, and from unchanged benzoic acid by steaming, contains 6·9 per cent. of ortho-, 1·1 per cent. of para-, and 92·0 per cent. of meta-nitrobenzoic acid; the amount of the ortho-acid actually formed is, however, probably greater than here given, some being dissolved during the removal of the sulphuric acid. W. A. D.

The Refraction Constant in Oil and Fat Analysis. By Henry R. Procter (*J. Soc. Chem. Ind.*, 1898, **17**, 1021—1025).—The value of the information obtainable from a determination of the refractive index of a fat can be considerably enhanced by calculating the specific refractive energy or refraction constant. The formula proposed by Gladstone and Dale $(n-1)/d$, where $n=$ index of refraction and $d=$ density, is fairly constant within the range of temperature suitable for such observations, but the expression $n^2-1/(n^2+2)d$, introduced by Lorenz and Lorentz, is still more closely constant, especially under extreme conditions, and is better adapted for calculating the refractive energy of a compound from the refraction equivalents of the elements.

The author gives a brief account of the Zeiss-Abbe refractometer, tables of the specific gravities, also refractive indices and refraction constants of a number of the commoner oils, fats, and fatty acids from his own determinations, and of the specific refractions of the chief fatty acids and glycerides calculated from the atomic refractions determined by Conrady, and indicates the manner in which a knowledge of these values may be applied to fat analysis. M. J. S.

Volatile and Insoluble Fatty Acids of Butter. By Robert Henriques (*Chem. Centr.*, 1898, ii, 797—798; from *Chem. Rev. Fett. Harz-Ind.*, **5**, 169—172).—This is a preliminary investigation intended to throw more light on the subject of edible fats.

The author has attempted to estimate the amount of volatile and easily soluble fatty acids in butter. The distillate obtained when applying the Reichert-Meissl test, after being carefully titrated, was evaporated to dryness and the residue further dried until the weight was constant. From the weight of the soap, the amount and average molecular weight of the acids may be calculated by means of the Reichert-Meissl number. The percentage of potash soap is called the "soap-figure." Calling this a, and the R.-M. figure b, the percentage of the volatile easily soluble acids equals $a-76b/1000$, and the average molecular weight of the same equals $1000\,a/2b-38$. Analyses of different butter-fats showed that whilst the molecular weights of the acids were almost the same, the amounts of acids were lower in the case of abnormal samples; the process is, therefore, at present, not adapted for the detection of butter mixtures.

The author has constructed a table showing the various analytical butter-figures, the results being obtained as follows. Five grams of fat is saponified with 25 c.c. of normal alcoholic potash, 10 c.c. of water is added, and the excess of alkali titrated with $N/2$ sulphuric acid; after adding a few drops of alkali, the alcohol is distilled off, 100 c.c. of water and 40 c.c. of dilute sulphuric acid (1 : 5) are added, and 110 c.c. is distilled off; 100 c.c. of this is then titrated with $N/10$ potash. The number of c.c. used multiplied by 1·1 represents the R.-M. number. The neutralised liquid is evaporated to dryness, and the weight of the residue, multiplied by 0·022, gives the soap figure, from which the percentage of free acids and their molecular weight are found by the above formulæ. The amount of easily volatile and soluble acids in butter of normal R.-M. figure is from 5—6 per cent.; in abnormal samples, from 4—5 per cent. Their average molecular weight varies from 93·3—99·8 per cent. L. DE K.

Cause of Rancidity of Butter. By CARL AMTHOR (*Zeit. anal. Chem.*, 1899, **38**, 10—20).—It has hitherto not been found possible to give numerical expression to the degree of rancidity of butter, and most of the chemists who have investigated the subject have arrived at discordant views as to the nature of the changes which produce rancidity. The author brings forward experiments which show that the development of rancidity is accompanied, not only by a large increase in the total acidity, and a smaller, but still very evident, increase in the amount of volatile acids, but that there is at the same time a production of volatile ethylic salts, principally ethylic butyrate, with small amounts of the salts of higher fatty acids. In the initial stages of rancidity, the volatile acids, chiefly butyric acid, predominate, and conceal the odour of the ethylic butyrate, but as the change progresses the latter becomes the more conspicuous. A loss of both volatile acids and volatile ethereal salts occurs on keeping, so that in very old butter none of the latter can be found, and in this state the butter has only a feeble odour resembling tallow. These changes are undoubtedly brought about by micro-organisms, which produce alcohol from the lactose, and at the same time split up the glycerides, especially the butyrin, the glycerol undergoing further changes which result in the formation of aldehydes and ketones. Since even fresh butter yields saponifiable substances when distilled, it would seem that the proportion of ethylic butyrate and volatile fatty acids should be employed as the criterion of rancidity. The co-operation of butter analysts in further investigation in this direction is invited.

M. J. S.

Analysis of Fats. VI. Detection of Cotton-seed Oil in Lard. By A. BÖMER (*Chem. Centr.*, 1898, ii, 646—648; from *Zeit. Unters. Nahr-Genussm.*, 1898, 532—552. Compare this vol., ii, 191, 192).—The paper is chiefly devoted to a criticism of the processes proposed for the detection of cotton seed oil in lard. Owing to the peculiar nature of American lard, neither the iodine absorption of the sample nor that of its liquid fatty acids is of much use to detect the adulteration. The same may be said of the various colour tests.

In separating the liquid fatty acids, it will be found advantageous to use the zinc instead of the lead soaps. It is probable that the iodine absorption may be found by acting directly on the ethereal solution of the zinc soap without previously liberating the oleic acid; this would save much time.

The best test at present is the phytosterol test. Enough phytosterol may be obtained from 10 grams of adulterated lard to make a microscopical examination. L. DE K.

The Arachidic and Lignoceric Acids of Earth-nut Oil and their Estimation. By LEONARD ARCHBUTT (*J. Soc. Chem. Ind.*, 1898, **17**, 1124—1126).—The mean molecular weight of the mixture of acids obtained from earth-nut oil by Renard's process (this Journ., 1872, 180) indicates that it is a mixture of arachidic and lignoceric acids, in which the latter largely predominates. The author modifies Renard's process by precipitating only a fraction of the fatty acids as lead salts; one gram of lead acetate is sufficient to convert the whole of the arachidic and lignoceric acids in 10 grams of earth-nut oil into lead soaps, and there is a great advantage in having less lead oleate to remove by ether. The 10 grams of oil is saponified by 4 grams of sodium hydroxide and 70 c.c. of alcohol; the soap, freed from alcohol, is decomposed by hydrochloric acid, and the fatty acids extracted by ether. After distilling off the ether, the acids are dissolved in 50 c.c. of 90 per cent. alcohol, and the warm solution is precipitated with 5 c.c. of a 20 per cent. solution of lead acetate. The precipitate is digested and washed with ether until free from lead oleate, then decomposed by hydrochloric acid in presence of ether, and the ethereal solution, after washing, is evaporated to dryness, and the residue, dissolved in 50 c.c. of hot 90 per cent. alcohol, is allowed to crystallise for 1 hour at exactly 15°. The crystals are collected on a Gooch filter, washed as prescribed by Renard (see also Tortelli and Ruggieri (Abstr., 1898, ii, 653) and weighed. The author confirms the statement of Tortelli and Ruggieri (*J. Soc. Chem. Ind.*, 1898, 876) that the correction to be applied for the solubility of the mixed acids in 90 per cent. alcohol is greater than was stated by Renard, and agrees with them that the correction must be varied according to the weight of the crystals ultimately obtained. A table for this purpose is given. M. J. S.

Estimation of Earth-nut Oil in Admixture with other Oils. By FERDINAND JEAN (*Chem. Centr.*, 1898, ii, 585; from *Ann. Chim. Anal. Applic.*, **3**, 220—221)—Ten grams of the sample to be tested for earth-nut oil is heated to 110°, 3 grams of potassium hydroxide dissolved in spirits of wine added, and the whole well stirred. The soap is then boiled in a reflux apparatus with 100 c.c. of 36 per cent. alcohol, previously saturated at 15° with potassium arachidate, until the mass is entirely dissolved. After being kept for 12 hours at 15°, the alcohol is drained off and the residue treated as before with 100 c.c. of the same alcohol. After removing the liquid portion, the solid soap is dissolved in 50 c.c. of hot water containing a little hydrochloric acid, and the liberated arachidic acid dissolved in light petroleum and recovered by evaporation. Its melting point should be 71—72°; 5·5 parts of arachidic acid represent 100 parts of earth-nut oil. L. DE K.

The Constants of Curcas Oil.—By LEONARD ARCHBUTT (*J. Soc. Chem. Ind.*, 1898, **17**, 1009—1010).—An undescribed sample of oil examined by the author was identified as Curcas oil. Its constants, in the crude state (*a*) and refined condition (*b*), as well as those of an undoubted sample of the refined oil (*c*), differed somewhat from those hitherto published.

	a.	*b.*	*c.*
Specific gravity at 15·5°	0·9205	0·9205	0·9205
Absolute viscosity at 15·5	0·858	0·878	0·864
Rise of temperature with 97 per cent. sulphuric acid (Maumené value)	67·5°	66·6°	65·0°
Saponification value (per cent.)	19·28	19·25	19·26
Iodine value	98·0	99·5	98·8
Hehner value	...	95·2	...
Acetyl value (Lewkowitsch)	14·03	9·82	8·36
Reichert-Meissl value	...	0·28	0·48
Acidity (as oleic acid) (per cent.)	11·8	0·36	4·46
Unsaponifiable matter (per cent.)	...	0·56	...
Melting point of fatty acids	...	27·5°	...

The crude oil was yellowish-brown in colour; the refined oil pale yellow. All three samples saponified readily. Sample *b* solidified at 2·8°. When exposed in a thin film on glass at 50°, sample *b* dried in about 24 hours, sample *c* in 30 hours. With nitric acid of sp. gr. = 1·375, sample *b* gave a pale brown colour, changing to orange after a time. The reactions with silver nitrate (Milliau), and with amylic alcohol, carbon bisulphide, and sulphur (Halphen) were negative. M. J. S.

Estimation of Nicotine in Tobacco. By RUDOLF HEFELMANN (*Chem. Centr.*, 1898, ii, 562—563; from *Pharm. Centr.-Halle*, **39**, 523—524).—The author states that he has for two years estimated nicotine in tobacco by a process similar to that described by Keller (this vol., ii, 193). Twenty grams of the sample, dried at 50°, or in a desiccator, is treated in a 300 c.c. glass-stoppered flask with 20 c.c. of 6 per cent. alcoholic potash until the powder is thoroughly moistened, 200 c.c. of ether is added, and the mixture well shaken and left to settle. Fifty c.c. of the ether is now pipetted off and allowed to evaporate in a porcelain dish; the crude nicotine remaining is dissolved in 10 c.c. of alcohol, and, after adding 50 c.c. of water, is titrated with $N/10$ sulphuric acid, using cochineal or hæmatoxylin as indicator. If a more accurate estimation is desired, 50 c.c. of the ethereal extract is distilled off, and the residue, after adding a few drops of aqueous soda and 10 c.c. of water, is distilled in a current of steam, when the distillate may be accurately titrated. L. DE K.

Separation and Estimation of Caffeine and Theobromine. By HEINRICH BRUNNER and HEINRICH LEINS (*Chem. Centr.*, 1898, ii, 512—513; from *Schweitz. Wochschr. Pharm.*, **36**, 301—303).—The authors propose the following method for the detection and estimation of caffeine and theobromine in such products as coffee, cocoa, kola, &c.: 10 grams of the powdered substance is boiled for half an hour with 500 c.c. of water, the evaporated water being replaced from time to time. Small quantities of lead hydroxide are now added until the liquid is colourless, the boiling is continued for another 15 minutes, the liquid filtered, and the residue extracted twice more with 500 c.c. of water; the mixed filtrate is boiled down to 500 c.c., and the lead removed by a current of carbonic anhydride. The filtrate, evaporated to dryness at 100° along with some clean sand, is extracted in a Soxhlet apparatus for 6 to 8 hours with ether. The residue left on evaporating the extract to dryness is extracted thrice with 50 c.c. of boiling water; after cooling to 50°, the liquid is filtered, evaporated nearly to dryness, and the residue dried at 80°. To separate the alkaloids, they are dissolved in hot water, silver nitrate is added, the precipitate dissolved in 2 to 3 c.c. of ammonia, and heated on the water-bath in the dark until the odour of ammonia has disappeared. When cooled to 30°, the silver theobromine ($C_7H_7AgN_4O_2$) is collected on a weighed filter and dried at 100°. The silver in the filtrate is precipitated with sodium chloride, the filtrate evaporated to dryness, and the caffeine extracted with ether. The alkaloid is dried at 100° and weighed. L. DE K.

Separation of Creatine. By E. F. LADD and P. B. BOTTENFIELD (*Amer. Chem. J.*, 1898, **20**, 869—871).—Neubauer's method for the separation of creatine gives somewhat higher values than the methods of Stradeler or Liebig. In Liebig's process, it is impossible to remove the last traces of barium by means of carbonic anhydride without a slight loss of creatine, whilst the use of alcohol in Stradeler's method involves the extraction of fatty material, in subsequently removing which a loss of creatine always occurs, although the error here is not so great as that in Liebig's method. W. A. D.

Comparison of Methods for Estimating Caffeine. By E. F. LADD (*Amer. Chem. J.*, 1898, **20**, 866—869).—The values obtained by the methods of Vite, Peligot, and Crosschoff are always lower than those obtained by Gomberg's process (Abstr., 1897, i, 129), which is at once the most accurate and most simple. Vite's method appears to be entirely untrustworthy. W. A. D.

Behaviour of Prussian Blue with Solvents in the Presence of Fat. By WILHELM FRESENIUS and LEO GRÜNHUT (*Zeit. anal. Chem.*, 1899, **38**, 31—33).—During the examination of a blue transfer paper for coal-tar dyes, the observation was made that Prussian blue ground with oil (what oil is not specified) yields, on treatment with either ether or chloroform, a clear blue solution, which can be filtered unchanged. When ground with oleic acid, the solutions were still more deeply coloured. With light petroleum, on the contrary, a perfectly colourless solution of the oil was obtained. M. J. S.

Estimation of Indigo-blue and Indigo-red in Natural and Synthetical Indigo. By W. F. KOPPESCHAAR (*Zeit. anal. Chem.*, 1899, **38**, 1—10).—The older methods of estimating indigotin are untrustworthy when applied to the product obtained by the methods in use at the present day for the manufacture of natural indigo, as this contains far more indigo-red than was formerly the case. The author gives the preference to a colorimetric method, on the ground of its directness and rapidity; it is, however, essential to remove at least the greater part of the indigo-red and indigo-brown, by digestion with glacial acetic acid in which both these colouring matters are soluble. Half a gram of the finely pulverised indigo is mixed with 100 c.c. of glacial acetic acid in a conical flask, and heated in the water-bath at 100° for an hour with frequent shaking; after allowing the undissolved substances to subside completely (the flask being left in an oblique position for an hour), the clear solution is carefully decanted through a filter of ignited asbestos, and if from the depth of colour of the solution the proportion of indigo-red seems to be considerable, the residue is again washed with glacial acetic acid. The residue in the flask and the asbestos filter are now treated with 50 c.c. of pure concentrated sulphuric acid and kept at 70° for 2 hours, the small quantity of acetic acid (about 6 c.c.) left in the flask being found to have no prejudicial influence. The solution is then diluted to 250 c.c. and 25 c.c. of this is again made up to 500 c.c. and is colorimetrically compared with a solution containing 0·1 gram of pure indigotin per litre. A special colorimeter based upon that of Salleron (this Journal, 1872, 527) is figured and described. For the estimation of the indigo-red, an aliquot part of the acetic acid extract is partially (about $\frac{3}{4}$) neutralised with sodium hydroxide, whereon the indigo-red is precipitated whilst the indigo-brown remains in solution. The precipitate is collected on a small filter and washed with a 5 per cent. sodium hydroxide solution and finally with water containing 2 per cent. of acetic acid, dried, dissolved in 50 c.c. of glacial acetic acid and compared colorimetrically with pure solution of indigo-red in glacial acetic acid (50 milligrams per litre). The latter may be conveniently prepared by diluting with water a glacial acetic acid extract of a suitable indigo, washing the precipitate with sodium hydroxide, and subliming it under reduced pressure. The synthetical indigo-red introduced into commerce by the Badische Anilin und Soda Fabrik is not identical with the natural substance, and is not free from indigotin. Like all colorimetric processes, the method requires acuteness of vision; in the author's case, the errors varied between 0·2 and 0·8 per cent. for indigo-blue, and for indigo-red were even smaller. M. J. S.

Estimation of Urinary Indican. By FRITZ OBERMAYER (*Zeit. physiol. Chem.*, 1899, **26**, 427—428).—Wang (Abstr., 1898, ii, 659) has described a method of estimating the indican in urine which is, in principle, the same as the author's (*Wiener klin. Rundschau*, 1898, No. 34). In some details, however, the methods differ, and these are commented upon. W. D. H.

Some Reactions of Biliary Acids and their Detection in Urine. By DIOSCORIDE VITALI (*Chem. Centr.*, 1898, ii, 1035; from *Boll. Chim. Farm.*, **37**, 609—617).—When biliary acids are slowly heated in a dish with concentrated sulphuric acid, the liquid turns first yellow, then orange yellow, and finally blood red. If the heat is raised until white fumes are visible, the liquid afterwards shows a green fluorescence; this can be observed even when the colours are not very plain owing to interfering matters. If biliary acids are moistened with sulphuric acid and then covered with hydrochloric acid, green streaks are noticed which turn blue, violet, and finally red. To isolate the acids from urine, the latter, after being acidified and concentrated, is mixed with chloroform and sufficient alcohol to dissolve this; on adding water, the chloroform (containing alcohol) separates and contains the biliary acids. Amylic alcohol also extracts the acids. To test for the acids in the presence of biliary colouring matters, the author decolorises the urine with freshly precipitated lead sulphide, and then tests for the acids in the filtrate.

L. de K.

Detection of Albumin and Albumoses in Animal Liquids. By E. Riegler (*Zeit. anal. Chem.*, 1899, **38**, 68; from *Pharm. Centr.*, 1897, 379).—A solution containing albumin, even at a dilution of 1:40000, gives with β-naphthalenesulphonic acid a precipitate insoluble on heating. Albumoses are also precipitated by this reagent, but the precipitate dissolves on heating, and reappears on cooling. Aluminium β-naphtholdisulphonate (so-called alumnol) in acid solutions is also a serviceable reagent. The author uses a solution containing 4 grams of alumnol and citric acid in 100 c.c., and adds 20—30 drops to 10 c.c. of the liquid to be tested. With this reagent also, the albumose precipitate dissolves on warming.

M. J. S.

Estimation of the Bitter Principles in Hops. By Carl J. Lintner (*Chem. Centr.*, 1898, ii, 684—685; from *Zeit. Ges. Brauw.*, **21**, 407—410).—The process recommended by the author is not intended as a commercial one for the valuation of hops, but promises to become of scientific interest. Into a 500 c.c. flask having also a mark at 505, 10 grams of the sample is introduced; 300 c.c. of light petroleum is added, and the flask is attached to a reflux condenser. The flask is heated by inserting it to the depth of 2—3 cm. in water at about 50°; it is important that the boiling point of the solvent should be between 30° and 50°. The bulk of the bitter principle is dissolved after about 2 hours, but the boiling is continued for 8 hours; when cold, the liquid is made up to the top mark at 17·5°, well shaken, and at once filtered. One hundred c.c. of the filtrate is mixed with 80 c.c. of commercial absolute alcohol, phenolphthalein is added, and the liquid is titrated with $N/10$ alcoholic potash containing as little water as possible. A blank experiment should be made to ascertain the amount of potash neutralised by the mixture of alcohol and light petroleum. The amount of alkali required by the sample multiplied by 0·4 represents the bitter principle (chiefly lupulin). Hops generally yield from 14·6—12·7 per cent. by this process.

L. de K.

General and Physical Chemistry.

Influence of Elements on the Optical Activity of the Amyl Radicle. By A. Brjuchonenko (*J. pr. Chem.*, 1899, [ii], **59**, 45—52).—When sulphur is introduced into the molecule of amyl compounds in direct combination with the amyl group, the specific rotation is largely increased. If either amylic sulphide or bisulphide is dissolved in carbon bisulphide, and sulphur is added to the solution, the specific rotation is not increased by the uncombined sulphur.

	AyOH.	AySH.	AySMe.	AySEt.	Ay_2S.	Ay_2S_2.	AyI.
$[\alpha]_D$	−4·34°	+2·20°	+12·30°	+13·75°			
	−4·40				+24·52°		+4·15°
	−4·30					+72·48°	

It is found that when elements of the same group of the periodic system are attached to the amyl radicle, they increase the specific rotation the more, the greater their atomic weights. Further, the influence increases from the 7th to the 5th group. The following table gives the values of the specific rotations, divided by two when two amyl groups are present; the amylic ether cited is isoamylic *l*-amylic ether.

$NHAy_2 = +2·80°$ $Ay_2O = +0·70°$ $AyCl^* = +1·24°$.
$Ay_2S = +12·26$ $AyBr^* = +3·50$.
$Ay_2Se = +20$ (?) $AyI^* = +5·41$.

* These were prepared from a sample of alcohol which had $[\alpha]_D = -5·7°$, the others from a sample with $[\alpha]_D = -4·4°$, to which correspond AyBr $[\alpha]_D = +2·51°$ and AyI $[\alpha]_D = +4·17°$, $[Ay = C_5H_{11}]$.

C. F. B.

Relation between Structural and Magneto-optic Rotation. By A. W. Wright and D. Albert Kreider (*Amer. Journ. Sci.*, 1898, [iv], **6**, 416—427).—It seemed possible that if an inactive compound, capable of forming active crystals, were allowed to crystallise in a magnetic field, one of the active forms might predominate, or that the field might in other ways influence the formation of active products. Experiments were first made with dextrotartaric acid, 5 grams of which, with 3 c.c. of water, were heated (1) under ordinary conditions, (2) in a strong magnetic field, but no difference was observable between the final products. Sodium chlorate was then allowed to crystallise in a magnetic field, and although the first set of experiments appeared to indicate an excess of dextro-crystals, further experiments proved that this was purely accidental, a field of 800 C.G.S. units having no effect on the crystals, although a tendency of the crystals to cluster in the strongest part of the field was observed both with sodium chlorate and with ferrous sulphate. Owing to the negative nature of these results, the authors repeated Kipping and Pope's researches on the crystallisation of sodium chlorate in dextrose solutions (Trans., 1896, 606), but without their definite results.

L. M. J.

Note by Abstractor.—The authors only refer to the abstract of Kipping and Pope's paper which appeared in the *Chemical News*, and appear to be familiar only with this, as they state erroneously that "Kipping and Pope do not state the number of results upon which they have based their conclusions." The difference is perhaps ascribable to the fact that the authors employed a 5 per cent. solution of dextrose, whereas Kipping and Pope used a 20 per cent. solution.

Spectra of Hydrogen. By THEODORE W. RICHARDS (*Amer. Chem. J.*, 1899, **21**, 172—174. Compare Abstr., 1897, ii, 199).—Hydrogen containing a trace of water vapour readily gives the red four-line spectrum when submitted to the continuous discharge, whereas the perfectly dry gas gives the "white spectrum," and a very great strength of current must be employed to obtain the red spectrum under these conditions. The heterogeneous water molecule more readily undergoes dissociation, and the red spectrum is characteristic of atomic hydrogen; the homogeneous hydrogen molecule is more stable, and the white spectrum is due to molecular hydrogen. G. T. M.

Anomalous Dispersion of Incandescent Sodium Vapour. By HENRI BECQUEREL (*Compt. rend.*, 1899, **128**, 145—151).—The author has continued his investigations of the anomalous dispersion of incandescent sodium vapour (*Compt. rend.*, 1898, **127**, 899), and has recognised that two different anomalous dispersions due to D_1 and D_2 respectively are superposed, the superposition being most distinct between the two lines, and in this interval there is an extraordinarily rapid variation in the index of refraction with a change in wave-length. For rays very near D_1 or D_2 but of somewhat shorter wave-length, the index of refraction is less than unity. It is noteworthy that, in this region, the vapour is at one and the same time absorbing and emitting rays of the same wave-length, and it would seem that this peculiar state of motion is the cause of the perturbations observed. The author's observations are in accord with the theory of anomalous dispersion propounded by Lord Kelvin and Helmholtz.

When the prismatic flame containing the incandescent sodium vapour is placed in a powerful magnetic field, the phenomena observed are due to a superposition of the anomalous dispersion and Zeeman's phenomenon. For a given wave-length, the vibrations parallel with the field have not the same index of refraction as the vibrations perpendicular to the field, and it follows that the vapour should be birefractive, as suggested by Voigt, who first observed the phenomenon. C. H. B.

Chemical Effects of X-Rays. By P. VILLARD (*Compt. rend.*, 1899, **128**, 237—239).—When photographic plates that have been exposed to the action of X-rays are afterwards exposed to light, the image undergoes reversal in the same way as if both exposures had been made to light, and the precise character of the phenomena depends on the relative magnitudes of the exposures. Plates exposed for some time to X-rays show increased sensitiveness to the less refrangible rays. C. H. B.

Electrosynthesis. By WILLIAM G. MIXTER (*Amer. J. Sci.*, 1898, [iv], **6**, 217—224. Compare Abstr., 1898, ii, 202).—The action of the electric glow discharge on different gaseous mixtures has been further studied.

The view previously expressed, that the heat resulting from the combination effected by the feeble glow discharge does not cause further combination, is confirmed. The use of a solution of potassium hydroxide, in place of the solid, does not influence the rate of change produced by the current through hydrogen and oxygen. It has been proved that, in the case of hydrogen and oxygen, the greater the pressure, the more rapid is the combination.

A mixture of ammonia and oxygen undergoes decomposition, about five-sixths of the nitrogen being liberated as such, whilst the remainder goes to form a deposit of ammonium nitrite on the side of the tube. Methylamine is oxidised more slowly than hydrogen and a certain amount of nitrite is formed; dimethylamine behaves in a similar manner, but trimethylamine does not yield nitrous acid. A mixture of aniline vapour and of oxygen at 30° under a pressure of 100 mm. contracts very slowly indeed, a brown condensation product being formed, but no nitrous acid. A mixture of dry cyanogen (1 vol.) and oxygen (2 vols.) first increases a little and then slowly contracts to about its original volume, and a considerable amount of carbonic anhydride, but no nitrous acid, is produced. When nitrous oxide itself is subjected to the glow discharge, complicated changes slowly occur, nitrite, and probably nitrate, being formed in the presence of potassium hydroxide. A mixture of nitrous oxide and hydrogen yields nitrogen and water. Nitric oxide, in the presence of potassium hydroxide, yields higher oxides when subjected to the glow discharge, and a mixture of nitric oxide and hydrogen reacts in a similar manner, but more slowly, nitrite being produced. A mixture of nitric and carbonic oxides yields but little carbonic anhydride. J. J. S.

Electro-chemical and Thermo-chemical Properties of Zinc and Cadmium Amalgams. By THEODORE W. RICHARDS and G. N. LEWIS (*Zeit. physikal. Chem.*, 1899, **28**, 1—12).—As the thermal capacity of an amalgam is approximately equal to the sum of the thermal capacities of the components, the heat of amalgamation is practically constant, and hence also the temperature coefficient of the E.M.F. must be constant, being given by the expression, $E/T - Q/ne_0$; the E.M.F. should, therefore, be a linear function of the temperature. The E.M.F.'s of cells of zinc and cadmium amalgams of various concentrations, and of amalgams against pure metal were determined, and it was found that, except in the case of the highest concentrations, the E.M.F. was in accord with the value calculated by the usual expression, and that E/T was constant and not affected by the nature of the anion. The heat of amalgamation of cadmium was found to be 505 cals., and that of zinc −2255 cals. The contact E.M.F. between the pure metal and amalgam was also determined, and was only appreciable in the case of cadmium amalgam, for which it reached about 0·05 volt.

L. M. J.

Alteration of Free Energy in Melted Halogen Compounds of some Heavy Metals. By VINCENT CZEPINSKI (*Zeit. anorg. Chem.*, 1899, **19**, 208—282).—In any chemical system, the changes in free energy, E, and total energy, Q, are connected by the relation $E = Q + T \cdot dE/dT$, where T is the absolute temperature. In the electrolysis of a fused electrolyte, the alteration of free energy, E, is easily obtained from the E.M.F. of polarisation, and the total energy, Q, from the heat of formation of the compound. The above expression hence becomes $n \cdot 23041 \cdot \epsilon = Q + T \cdot d\epsilon/dT \cdot n \cdot 23041$, where ϵ is the E.M.F. of polarisation, n the valency of the reacting substances, and 23041 the factor, for conversion into Calories. From measurements, therefore, of the E.M.F. and temperature coefficient, the heat of formation may be calculated. The salts were melted in V-tubes of hard glass contained in a sand mantle in a gas furnace, the temperatures being taken with a Le Chatelier pyrometer; electrodes of carbon, one reaching to the bend, the other to the surface of the molten salt, were employed, and the polarisation was compared with that of a Clark cell by the aid of a ballistic galvanometer. Zinc chloride was first examined, and it was found that by electrolysis the salt could be obtained perfectly anhydrous, no metal being deposited for some time, during which the polarisation increased; when the salt is anhydrous, the polarisation becomes constant and metal is formed; it is noteworthy that the salt is a better conductor when anhydrous than when slightly hydrated. The polarisation was also determined by the direct measurement of the E.M.F. of the chain C | Zn | $ZnCl_2$ | Cl | C, the gas electrode being obtained by the use of a carbon wick. The polarisation varied from 1·5765 volts at 408° to 1·2089 volts at 728°; the temperature coefficient was almost constant, being 0·00075 up to 600°; above this, it appeared to decrease, but the values are not trustworthy. From the numbers, the heat of formation is found to be 95·86 Cal. at 408° and 96·1 Cal. at 468°; the value found by Thomsen was 97·2 Cal. at 18°, which leads to the values 95·9 Cal. and 97·59 Cal. at the above temperatures, neglecting, however, the latent heat of fusion of the salt. From the difference between the heat of formation, just above and below the melting point, the molecular heat of fusion of zinc is calculated as 1·94 Cal., a result in accord with the actual value 1·83 Cal. Similar values for the other salts investigated are contained in the accompanying table, in which the column Q^1 contains the values for the heat of formation deduced from Thomsen's and Berthelot's observations at lower tempera-

Salt.	Temperature.	ϵ (in volts).	$-d\epsilon/dt$.	Q.	Q^1.
Zinc bromide ...	390°	1·3342	0·0006	80·1	
„ „ ...	560	1·1849	0·001		
Lead chloride...	466	1·2714	0·0008	84·7	82·8
„ „ ...	706	1·096	0·0009	92·3	
Lead bromide...	389	1·1114	0·0007	72·2	71·9
„ „ ...	700	0·8532	0·00097	89·5	
Lead iodide......	405	0·6943	0·00067	51·6	44·3*
„ „ ...	700	0·4842	0·00069		
Silver chloride .	460	0·9106	0·00039	26·8	about 27
„ „ ...	720	0·8258	0·00053		
Silver bromide..	440	0·8129	0·00044	25·2	25·2
„ „ ...	680	0·6961	0·00066		
Silver iodide ...	320	0·6189	0·00045	19·2	17·9
„ „ ...	740	0·4948	0·00020		

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* Polarisation value probably high owing to difficulty of obtaining lead iodide perfectly free from oxygen.

tures. The values here given are the extremes of the trustworthy results, but numerous intermediate values are given in the paper.

A number of molecular latent heats of fusion were calculated as in the case of zinc chloride, namely, silver iodide, 1·573 Cal.; lead bromide, 3·578 Cal.; and lead chloride, 4·13 Cal. The E.M.F.'s of the cells $Zn \mid ZnCl_2 \mid PbCl_2 \mid Pb$ and $Zn \mid ZnBr_2 \mid PbBr_2 \mid Pb$, were also determined, the values agreeing well with the differences between the E.M.F.'s of polarisation of the two salts. Comparison of the complete results shows that the temperature coefficients of the halogen compounds of a metal differ but little, that of the bromide being the greatest, and that of the iodide least, a result in accord with the conclusions of Bodländer (Abstr., 1897, ii, 554). L. M. J.

Alteration of Free Energy in Molten Halogen Compounds of some Heavy Metals. By RICHARD LORENZ (*Zeit. anorg. Chem.*, 1899, **19**, 283—290).—It was shown by Czepinski (preceding abstract) that the E.M.F. of the chain $Zn \mid ZnCl_2 \mid PbCl_2 \mid Pb$ is equal to the difference between the E.M.F.'s of the two chains, $Zn \mid ZnCl_2 \mid Cl$ and $Pb \mid PbCl_2 \mid Cl$, and the same obtains for similar bromide cells, the E.M.F. in both cases being almost independent of temperature. It hence follows that the ion pressure is approximately equal in melted lead and zinc chlorides, and in lead and zinc bromides. In Czepinski's experiments, the temperature coefficient remained approximately constant for a considerable range of temperature, and from the mean value for this range the heat of formation of each compound is calculated. If the reactions be represented thus, $Ag + Cl \rightleftarrows AgCl$, &c., then the free energy is given by the expression, $RT\{\log C_1C_2/C + \log c/c_1c_2\}$, where C_1C_2C are actual and c_1c_2c the equilibrium concentrations of the three components; if $c/c_1c_2 = K$, then $d\log K/dT = -Q/RT$, so that the ratios of K at various temperatures are calculable. For zinc, lead, and silver chlorides, and silver and lead bromides, it is found that the value of K decreases considerably with rise of temperature, that is, the quantity of undecomposed salt, in the equilibrium state, decreases with rise of temperature. L. M. J.

Latent Heats of Vaporisation of Liquids. By WLADIMIR F. LUGININ (*Ann. Chim. Phys.*, 1898, [vii], **13**, 289—377).—In order to determine the latent heats of vaporisation, it was first necessary to obtain the specific heats of the liquids examined between their boiling points and ordinary temperatures, and also to determine the variation of boiling point with pressure; the methods and results of this preliminary work are fully described. The following liquids were examined: ethylic, propylic, isopropylic, butylic, isobutylic, active amylic, fermentation amylic, allylic, and benzylic alcohols; amylene hydrate, ethylenic glycol, methyl ethyl ketone, methyl isopropyl ketone, diethyl ketone, methyl butyl ketone, dipropyl ketone, methyl hexyl ketone, mesityl oxide, benzaldehyde, ethylic oxalate, ethylic carbonate, methylic carbonate, acetal, decane, octane, and benzene. They were all purified as completely as possible, and in many cases had an absolutely constant boiling point. The specific heats were determined by the method of mixtures, and it is noteworthy that, in spite of the extreme care observed, the values obtained with the same specimen frequently differed by over 1 per cent. The latent heats of vaporisation were determined in the usual manner, and results were obtained agreeing to within 1 per cent., a mean of four determinations being usually employed. In the case of the alcohols examined, the latent heat was found to decrease with increase of molecular weight, and the values differ for isomerides, that of the normal compound being the greater. For ethylic, isopropylic, butylic, isobutylic, and allylic alcohols, and ethylenic glycol, the values MS/T (T=absolute boiling point) have a practically constant value of about 26·1 to 26·5, the three amylic alcohols give a lower value (about 25), whilst for benzylic alcohol the value is only 22·9. For the ketones studied, MS/T is markedly less than for the alcohols, the mean value being 20·83, with extremes of 21·29 and 20·57; the values given by benzaldehyde and mesityl oxide also agree with these ketonic values. The ethereal salts give values slightly greater than those of the ketones, the mean being 21·79, whilst the hydrocarbons examined gave numbers approximating to 20. It appears, therefore, that Trouton's law, $MS/T=k$, is approximately valid, but that the value of k varies somewhat with different series of compounds, being abnormally great in the case of the alcohols. The abnormal value is probably due to complex groups which have been proved to exist in alcohols, and in this series also, it is most marked for those compounds in which, according to Ramsay and Shields, the greatest complexity occurs. The magnitude of the expression MS/T may thus serve as a means of recognising the existence of liquid complexes, the normal value being taken as about 20 to 21. The heats of combustion of the compounds examined are only known for the liquid state, but by adding the values found for the latent heats, the heats of combustion for the gaseous state may be obtained. The correction, in general, amounts to about 2 or 3 per cent., and the values so corrected are given (compare Abstr., 1896, ii, 146). L. M. J.

Specific Volumes and Thermodynamic Relations of Steam: Regnault's Calorie. By G. P. STARKWEATHER (*Amer. Jour. Sci.*, 1899, [iv], 7, 13—33; 129—142).—The work involves chiefly a careful reinvestigation of Regnault's calculations of the latent and total heat of steam. The temperatures are shown to have been reduced to the air thermometer, and the chief error in the determinations to be due to the assumption of a constant specific heat of water. Corrections are made employing the expression $h=1{\cdot}00449t-0{\cdot}0_{3}1904t^{2}+0{\cdot}0_{5}1813t^{3}$ for the total heat of water, and it is proved that the correction gives values for the latent and total heats of steam more concordant than the values calculated by Regnault's formulæ; and an expression, $H=603{\cdot}2+0{\cdot}356t-0{\cdot}0021t^{2}$, is proved to furnish better values for the total heat of steam above 100° than does Regnault's linear formula. For temperatures below 100°, the expression $598+0{\cdot}442t-0{\cdot}0_{3}64t^{2}$ is in accord with Dieterici's and Regnault's experiments. The values for the specific volumes of saturated steam may be calculated from the latent heat, and many experimental determinations of these and of the volumes of superheated steam have been made by Battelli, and by Ramsay and Young, but the author comes to the conclusion that the discrepancies in these determinations are irreconcilable, and hence that our knowledge of the specific volumes of steam is limited to the saturation point. The 'equation of condition' connecting temperature, pressure, and volume is investigated, that finally adopted being $p = RT(v - a) - A/Tv^{3/2}(v^{\frac{1}{2}} + \gamma)$, and the necessary constants are given. A table is finally given for the values of the total heat, latent heat, pressure, volume, entropy of water, entropy of dry steam, and energy of dry steam at temperatures up to 200°, the heat being in terms of the specific heat of water at 15°. L. M. J.

Heat Developed on Adding Water to Excess of Sulphuric Acid. By Marcellin P. E. Berthelot (*Ann. Chim. Phys.*, 1898, [vii], **13**, 77).—The amounts of heat developed on successively adding equal quantities of water (1—4 mols.) to excess of sulphuric acid (20 mols.) are as follows:—1st, $H_2O = +7·5$ Cal.; 2nd, $H_2O = +7·26$ Cal.; 3rd, $H_2O = +7·07$ Cal.; 4th, $H_2O = +6·93$ Cal.

G. T. M.

New Method for the Determination of the Melting Points of Fats. By Henry R. le Sueur and Arthur W. Crossley (*J. Soc. Chem. Ind.*, 1898, **17**, 988).—Into a small, thin-walled tube, a fine capillary tube open at both ends is placed. The diameter of the capillary should not be more than 0·75 mm. A small portion of the substance is introduced into the bottom of the outer tube, so that the end of the capillary is well surrounded by it, the tube is then attached to a thermometer and heated in the usual manner, the temperature at which the liquid is seen to rise in the capillary being taken as the true melting point. The method is accurate, and the observed melting point is not influenced by the position of the capillary in the wider tube.

J. J. S.

Stannic Bromide as a Solvent in Cryoscopic Determinations. By Felice Garelli (*Gazzetta*, 1898, **28**, ii, 253—261).—The author finds that stannic bromide is sometimes useful as a solvent in the determination of molecular weights by the freezing point method; it offers the advantage of having a very high molecular depression, and further, it melts at a temperature (about 30°) very convenient in practice.

Benzene and acetophenone turn stannic bromide yellow, but many other organic substances, especially halogenated derivatives, dissolve in it without change.

A number of determinations with solutions of different substances points to a mean value of 280 for the molecular depression of freezing point.

Stannic chloride and iodide, when dissolved in stannic bromide, produce molecular depressions greater than the theoretical value, showing that they do not form solid solutions; in connection with this, it is pointed out that stannic bromide and iodide are not isomorphous. T. H. P.

Apparatus for Determining the Specific Gravity of Pulverulent Substances. By Gustav J. W. Bremer (*Rec. Trav. Chim.*, 1898, **17**, 405—406).—The author has recently described (this vol., ii, 81) an apparatus for measuring the density of pulverulent substances, but was not at that time aware of the papers of Paalzow (*Ann. Phys.*

Chem., 1881, [ii], **13**, 222, and **14**, 176) and Baumhauer (*Arch. Néerl.*, 1868, 385), in which volumemeters are described similar to the author's in general principle. He believes, however, that his own apparatus possesses the following advantages over all others: (1) The volume of the flask can be chosen in accordance with the volume of the substance to be contained in it. (2) The increase in volume for the diminution of pressure can be regulated so that the effect is a maximum. A. L.

Tables for Correction of Temperature in Pyknometric Measurements. By PAUL FUCHS (*Zeit. angw. Chem.*, **1899**, 25—27).—The author prefers taking the capacity of sp. gr. bottles by filling them with water at the temperature of the laboratory; this, however, necessitates several corrections. To facilitate the work, he has constructed four tables. The first one gives the increase in volume of sp. gr. bottles when the temperature rises from 4° to 30°; the second, the expansion of water between these temperatures; the third, the capacity of the specific gravity bottle at 4° when the water used has a temperature between 4° and 30°; whilst the fourth table serves to calculate *d* 15°/15° to *d* 15°/4°.

Examples are given showing the way of using the tables.

L. DE K.

Viscosity of Undercooled Liquids. By GUSTAV TAMMANN (*Zeit. physikal. Chem.*, 1899, **28**, 17—32).—Viscosity is commonly regarded as the criterion of the solid or liquid state, but the author points out that undercooled liquids have a viscosity approaching that of crystals, whilst some crystals have a viscosity approaching that of liquids, with a definite change at the melting point (Abstr., 1898, ii, 563). There is, further, no discontinuity in the change from a liquid to an amorphous solid, and the latter may hence be regarded as an undercooled liquid. In order to determine whether any discontinuity in the viscosity occurs during the undercooling of liquids, the author made determinations of the viscosity at various temperatures reaching far below the melting point in the case of the following substances:—piperine, α-naphthylic salicylate, β-naphthylic salicylate, peucedanin, cocaine, papaverine, cane sugar, leucine, and glucose. The method first employed was that used by Jones (*Phil. Mag.*, 1894, **37**, 451) namely, the measurement of the time of fall of a heavy sphere through the liquid, but afterwards a more speedy method was found to consist in the observation of the velocity with which a glass filament was drawn out of the liquid by a constant force. In no case was any discontinuity found in the viscosity | temperature curve, and measurement usually became impossible at from 100° to 50° of undercooling. The expansion curve of β-naphthylic salicylate was also found to be perfectly continuous up to temperatures at which the compound is quite hard, so that the change from liquid to amorphous solid is quite continuous. L. M. J.

Velocity of Crystallisation. By GUSTAV TAMMANN (*Zeit. physikal. Chem.*, 1899, **28**, 96—98).—A final reply to Küster (this vol., ii, 15), in which the author upholds his contention that the temperature of the freezing point prevails in the limiting layer of an undercooled liquid during solidification. L. M. J.

Change of Entropy in the Dissociation of similar Heterogeneous Systems. By Camille Matignon (*Compt. rend.*, 1899, **128**, 103—104).—When comparable chemical systems, such as the compounds of metallic chlorides with ammonia, undergo heterogeneous dissociation, the heats of formation of the compounds from the products of dissociation are proportional to the absolute temperatures corresponding with the same dissociation pressure. In the case of the ammoniacal chlorides of zinc, calcium, silver, magnesium, palladium, and lithium, the quotient Q/T (where Q is the heat of formation of quantities of the compounds that liberate the same amount of ammonia, and T is the absolute temperature at which the dissociation pressure is equal to the atmospheric pressure in each case), is practically constant and varies only from 0·31 to 0·337, although the value of T varies from 285° to 453°. Since Q/T represents the change of entropy corresponding with a reversible chemical change at atmospheric pressure, it follows that when similar systems dissociate with the same dissociation pressure, the change in entropy is the same in all the systems. C. H. B.

The Theory of Osmotic Pressure. By K. Schreber (*Zeit. physikal. Chem.*, 1899, **28**, 79—95).—If two similar aqueous solution, of an electrolyte be separated by a semipermeable membrane which allows the passage of only one ion, then each side is subject to an equal osmotic pressure, but if an electric current passed through the liquid in a direction at right angles to the plane of the division, then one side of the division experiences an increase of pressures analogous to a wind pressure, owing to the increased velocity of the ions in the direction of the current. A copper ferrocyanide membrane is impermeable to copper, zinc, and SO_4'' ions, but permeable to potassium and NO_3' ions. In the solutions of copper or zinc nitrate, an increase of pressure was found on the side opposed to the anode; in solutions of potassium sulphate on that opposed to the cathode; whilst in solutions of copper sulphate no increase of pressure occurs—results which are in accord with the theory. The author deduces, on the basis of the kinetic theory as applied to solutions, an expression for the magnitude of this 'ion-wind pressure,' which should be proportional to the E.M.F. and to the partial pressure of the ion. Experiments showed that in any particular cell the pressure is actually proportional to the E.M.F., but it was found that the ratio dP/dE varied to a very great extent (in ratio 1:76) when different cells were used, and as this variation is inexplicable theoretically, and as the actual values are not of the same order of magnitude as those calculated, the author considers that the kinetic theory cannot be applied to solutions. L. M. J.

Osmotic Pressure of Ethereal Solutions. By H. M. Goodwin and George K. Burgess (*Zeit. physikal. Chem.*, 1899, **28**, 99—114).—Noyes and Abbot have shown that the osmotic pressure of ethereal solutions of naphthalene and azobenzene is approximately proportional to the concentration, that is, Boyle's law is obeyed in these solutions (Abstr., 1897, ii, 395). Whilst, however, the numbers in the case of azobenzene are approximately constant, yet, for the naphthalene solutions, the ratio P/C decreases with increase of concentration, and the variation is too great to be referred to experimental errors. The authors, therefore, again investigated the question, and determined the vapour pressure of ether and of various solutions by the dynamical method, temperatures being taken by a platinum resistance thermometer. The compounds employed were diphenylamine, naphthalene, and benzophenone and in each case the ratio P/C was found to decrease with increase of concentration, that is, PV decreases with increase of pressure as in the case of easily compressible gases. For diphenylamine, the curve of PV against P appeared to indicate that a minimum exists, after which the value again increases, exhibiting a further analogy to the gas laws. Azobenzene is, therefore, the only compound examined for which the simple law is applicable.

L. M. J.

Cause of Osmotic Pressure. By F. Barmwater (*Zeit. physikal. Chem.*, 1899, **28**, 115—144).—The author endeavours to prove that the various phenomena depending on osmotic pressure may be explained on the assumption that this is due to an attraction between the molecules of the solvent and the solute, and do not necessitate the supposition that the molecules of the latter move freely as in the gaseous state. On this hypothesis he deduces the van't Hoff expression $PV = RT$, and shows that Abegg's cryoscopic observations on aqueous and benzene solutions are in accord with his theory. In the case of dissociated compounds, he deduces the dilution formula $\mu_\infty = \mu + g\sqrt[3]{\mu/v}$, and shows that, in the case of solutions of potassium and sodium chlorides, this expression gives results which are at least as closely in accord with the experimental values as those obtained by the use of Kohlrausch's formula. The values of μ and g are given for a large number of salts, and the expressions deduced are applied to find the osmotic pressure and dissociation of some salt solutions, the results being concordant. L. M. J.

Solubility of Acids in Solutions of the Salts of other Acids. By Arthur A. Noyes and Edward S. Chapin (*J. Amer. Chem. Soc.*, 1898, **20**, 751—756; and *Zeit. physikal. Chem.*, **27**, 442—446).—Determinations of the solubility of benzoic acid in solutions of sodium acetate and sodium formate, at various concentrations, were made, and the values found were compared with those calculated by the aid of the expressions deduced by Noyes (this vol., ii, 9). The agreement was very close, as shown by the following numbers, which are the values for the highest concentrations.

Sodium acetate.			Sodium formate.		
Concentration of salt.	Sol. calc.	Sol. found.	Concentration.	Sol. calc.	Sol. found.
0·00000	0·02793		0·0000	0·02793	
0·05282	0·06380	0·06480	0·05657	0·04553	0·04530

L. M. J.

Reaction between Potassium Permanganate and Hydrochloric Acid under the Influence of Catalytic Agents. By JULIUS WAGNER (*Zeit. physikal. Chem.*, 1899, **28**, 33—78).—In the estimation of ferrous salts by potassium permanganate, the presence of hydrogen chloride necessitates the use of excess of the permanganate owing to this reacting with the acid and evolving chlorine. The author investigated this reaction especially in regard to the action of various salts as catalytic agents. Sulphates have usually a retarding influence, and this is very marked in the case of aluminium sulphate, probably owing to the slight dissociation of aluminium chloride, and the consequent removal of chlorine ions; other salts, such as the acetates, were also found to retard the reaction. Chlorides, however, usually cause an increase in the quantity of permanganate required, that is, have an accelerating effect; barium chloride has a very marked action and also causes oxidation of oxalic acid by permanganate in the cold; the action in this case is probably due to the intermediate formation of a peroxide. The chlorides of platinum, chromium, and cadmium have also a marked action on the permanganate, the quantity of the latter required for the oxidation of a definite quantity of oxalate being greater than when hydrochloric acid of equal chlorine concentration is added. The action of platinic chloride was further examined, and is most probably due to the formation of hydrogen platinochloride, which reacts with the permanganate more readily than hydrogen chloride itself. Electromotive force determinations also show that this compound has the lower decomposition point. It is probable that the activity of the chlorides of chromium, gold, and cadmium is also due to the formation of an acid chloride; indications of the presence of a compound of this kind in the case of cadmium chloride are given both by the E.M.F. determinations and by cryoscopic experiments. The author suggests that cases such as these, in which the acceleration is due to secondary reactions, should be distinguished by the term 'pseudo-catalysis.'

L. M. J.

Velocity of Inversion in Aqueous Alcohol. By ERNST COHEN (*Zeit. physikal. Chem.*, 1899, **28**, 145—153).—The author has previously shown that the dissociation of electrolytes, as measured by the conductivity, is equal in aqueous alcohol and in pure water (Abstr., 1898, ii, 154). The velocity of inversion of cane sugar is, however, diminished by the addition of alcohol, and this was, therefore, examined further. Hydrogen chloride was employed as hydrolyst, and it was found that the ratio of the velocities in water and in 50 per cent. alcohol was independent of the concentration of the sugar, but increased with the dilution of the acid, reaching a constant value of 1·5 at about *N*/32. In 20 per cent. alcohol, the constant ratio is much smaller, about 1·05, and is already reached at the concentration *N*/8. As at very high dilution the dissociation is complete in both solvents, it follows that the difference in the velocities is not due to dissociation differences, but to a specific action on the velocity of reaction of the medium in which the reaction takes place.

L. M. J.

Dynamical Researches on the Formation of Azo-compounds. III. By HEINRICH GOLDSCHMIDT and EMIL BÜRKLE (*Ber.*, 1899, **32**, 355—378. Compare Abstr., 1897, i, 278; 1898, ii, 20).—The relation between the velocity of formation of azo-compounds, formed from diazobenzenesulphonic acid and tertiary amines, and the strength of the acid used, is shown in the following table.

The expression $k_{HCl} = kx$ indicates that the velocity of formation is the same when other acids of the same strength are used in place of hydrochloric acid, the hydrolytic constant x, for weaker acids, being dependent only on the dissociation constant of the acid, and not on its constitution, therefore the constant of velocity, $ks = kx/k' = k_{HCl}/k'$, where k' is the dissociation constant of the acid.

Acid.	Base.	δ.	k_{HCl}.	$100k'$.	$\frac{k_{HCl}}{k'}$.	ks Found.
Chloracetic acid	Diethylaniline	25°	0·00145	0·155	0·94	1·15
Acetic acid	,,	25	0·00145	0·0018	80·6	77·7
,,	,,	20	0·00095	0·0018	52·8	49·2
Formic acid	Dimethylaniline.	20	0·00053	0·0214	25·0	25·8
,,	Diethylaniline	20	0·00095	0·0214	4·4	3·9
Propionic acid	,,	20	0·00095	0·00134	70·9	61·0
,,	,,	25	0·00145	0·00134	108·2	108·7
Levulinic acid	,,	20	0·00085	0·0025	37·3	38·3
,,	,,	25	0·00145	0·0025	57·0	75·3
Lactic acid	,,	20	0·00095	0·0310	3·1	3·1
,,	,,	25	0·00145	0·0310	4·7	5·0

From the consideration of numerous other instances of the velocity of formation of azo-compounds from diazonium salts, &c., the assumption made by the authors in the case of the formation of amidoazo-compounds, namely, that that part only of the tertiary amine which is set free by the hydrolysis of the salt combines as such with the diazo-compound, appears to be proved. J. F. T.

Solubility and Melting Point as Criteria for Racemic Compounds, Pseudoracemic Mixtures, and Inactive Conglomerates. By H. W. BAKHUIS ROOZEBOOM (*Ber.*, 1899, **32**, 537—541).—Racemic compounds, pseudoracemic mixtures, and inactive conglomerates can be readily distinguished the one from the other by determining either the curve of solution at constant temperature, or the melting point curve of the solid, or the solidifying curve of the liquid substance.

In this way, the racemic nature, or otherwise, of a substance having the same or a lower melting point than its active constituents can be definitely determined. The term inactive conglomerate is considered to best express a mere mixture of the active constituents. The subject will be discussed in detail in a forthcoming paper in the *Zeit. physikal. Chem.* J. F. T.

What is a Chemical Individual? By F. WALD (*Zeit. physikal. Chem.*, 1899, **28**, 13—16).—Tammann has shown that the water content of certain hydrated salts varies continuously (this vol., ii, 8), and the author, considering that this throws doubt on the accepted atomistic laws of definite and multiple proportions, again reviews the question as to what is a chemical individual, with reference to his definition deduced on the basis of phase law (Abstr., 1898, ii, 159).

L. M. J.

Filtration. By JEAN HAUSSER (*Compt. rend.*, 1899, **128**, 112—114).—The author has investigated the rate of passage of water and alcohol through finely divided kaolin, calcium phosphate, and animal charcoal in uniform layers of different thicknesses and under different pressures. The rate of flow is constant for the same liquid and the same filtering medium, and is inversely proportional to the thickness of the layer of one and the same substance. Other conditions being constant, the rate of flow diminishes as the pressure is reduced and increases as the pressure is increased up to a certain point, beyond which it becomes independent of the pressure.

Crystalline filtering media yield different and less uniform results.

C. H. B.

Filtration of Organic Liquids. By JEAN HAUSSER (*Compt. rend.*, 1899, **128**, 242—243. Compare preceding abstract).—The author has made experiments on the filtration of various typical carbon compounds through layers of kaolin, animal charcoal, and calcium phosphate. The filtering layer is not affected by the passage of successive quantities of different liquids, that is to say, the respective rates of filtration are not affected if different liquids are passed through a given filtering layer one after the other in any order. The relative rates of filtration of different liquids are independent of the nature of the filtering material. By adjusting the thicknesses of the three filtering materials, it is possible to prepare filters that are equivalent whatever the nature of the liquids. For equivalent filters and for a given pressure, each liquid has its own coefficient of filtration. These conclusions hold good also for solutions of carbon compounds in alcohol of 90°, but they do not hold good for aqueous solutions.

C. H. B.

Filtering small quantities of Liquid. By HENRY VON WINKLER (*Chem. Zeit.*, 1898, ii, 1066).—When filtering a few c.c. of liquid, it often happens that the solution does not readily pass through the filter and partly evaporates. The apparatus devised by the author consists essentially of a glass plate of which one side is ground and having at its centre a projecting tube fitted to a rubber tube. A funnel with ground edges is fitted with strong paper and filled with the liquid; the disc, which may also be made of vulcanite, is placed on the top of it, and held in position with the fingers while the liquid is forced through the filter by blowing air through the tube.

L. DE K.

A New Separating Funnel. By GEORG W. A. KAHLBAUM (*Ber.*, 1899, **32**, 509—510).—The author describes a novel form of separating funnel in which the tap is superseded. The escape tube fits closely into a ground-glass conical jacket, on the inner surface of which a groove has been cut for a portion of its length on one side. In one position, the groove makes a continuous channel with the escape tube, but on rotating the jacket, communication is interrupted.

M. O. F.

Inorganic Chemistry.

Metallic Halogen Salts. By VICTOR THOMAS (*Ann. Chim. Phys.*, 1898 [vii], **13**, 145—231. Compare Abstr., 1895, ii, 271, 450, 495; 1896, ii, 26, 365, 429, 527, 608, 609; 1897, ii, 145, 262, 377; 1898, ii, 585).—A detailed account of work already published. G. T. M.

Constitution of Inorganic Compounds. XV. Chloro-salts. By ALFRED WERNER (*Zeit. anorg. Chem.*, 1899, **19**, 158—178).—A review of all the known chloro-salts shows that those chlorides which act as anhydrides of chloro-acids are, as regards their power of forming salts, analogous to the oxygen acids, that is, that the reactions expressed in the following equations, $K_2O + SO_3 = K_2O,SO_3$ and $KCl + AuCl_3 = KCl,AuCl_3$, are analogous, and the products of both reactions are salts of the second order. Some of the anhydrides of chloro-acids enter into reaction as simple molecules: for instance, copper chloride, manganese chloride, and platinum chloride; others show a tendency to act as polymeric acid anhydrides in a somewhat similar manner to chromium and tungsten trioxides: for example, lead, gold, and mercury chlorides. The tervalent elements show this tendency in a marked degree; the quadrivalent elements do not. The same chloro-compound can give rise to different definite acids in a similar manner to that in which the anhydrides of oxygen acids do. Thus, as phosphoric anhydride yields different acids according to the different degrees of hydration, so, in a similar manner, cadmium chloride is able to form salts with 1, 2, or 4 molecules of an alkali chloride. The limit is always reached when the number of chlorine atoms in the acid radicle becomes six. In the case of hydrated chloro-salts, also, the sum of the chlorine atoms and water molecules is never greater than six.

E. C. R.

Relation of Hypochlorites to Chlorates. By FRITZ FOERSTER and F. YORRE (*J. pr. Chem.*, 1899, [ii], **59**, 53—101).—The reaction of chlorine with the solution of an alkali hydroxide is usually described as follows. In cold, dilute solutions, hypochlorite and chloride are formed; in hot, concentrated solution, chlorate and chloride are obtained. Such statements completely ignore the work of Gay Lussac, who pointed out long ago (*Compt. rend.*, 1842, **14**, 927, or *Annalen*, **43**, 153) that the conversion of hypochlorite to chlorate does not so much require a high temperature and a concentrated solution, as the absence of alkalinity, obtained by saturating the solution with chlorine.

The authors have investigated the matter anew. They passed chlorine gas (prepared by electrolysis with platinum electrodes, and consequently free from carbonic anhydride) into a freshly prepared solution of sodium hydroxide of about 25 per cent. strength, the containing vessel being immersed in cold water and shaded from light; when prepared, the hypochlorite solution was allowed to remain in the dark, at the ordinary or at some other temperature. From time to time, samples were removed, and the available oxygen was estimated: that in the hypochlorite with arsenite solution, and the total amount by distillation with concentrated hydrochloric acid, the distillate being collected in potassium iodide solution, and the iodine which was liberated, titrated. Dissolved chlorine gas was first removed by aspirating air through the solution. By making estimations at intervals while the chlorine was being passed in, the extent to which the alkali was saturated could be ascertained; complete saturation was attained when the total available oxygen corresponded with that theoretically obtainable with the amount of sodium hydroxide employed.

If the alkali solution is not quite saturated with chlorine, the slightly alkaline hypochlorite solution formed is very stable at the ordinary temperature; after 4 weeks, only 14 per cent. of the hypochlorite had been converted into chlorate, but at the same time a small quantity of oxygen gas had been evolved. In daylight, the conversion is somewhat more rapid, and the same is the case at 50°, whilst at 90°, 67 per cent. was converted in 2 hours; the more rapid conversion, however, was attended by a greater loss owing to evolution of gas, and this loss is greater the more alkali is present. If a slight excess of chlorine is present above the amount required to saturate the alkali, the conversion is very rapid at the ordinary temperature; after some 2 hours, 93 per cent. of the hypochlorite was converted into chlorate, and the loss corresponded with but a fraction of a per cent. If the text-book method is adopted, and concentrated caustic soda is saturated at 90—95° with chlorine, 88·5 of the theoretical yield of chlorate is obtained, but there is a loss of 10·5 per cent. A rapid, and almost equally complete conversion, is attained by adding a small quantity of an acid; sulphuric, phosphoric and acetic acids and sodium hydrogen carbonate were experimented with, and it was found that the extent of the conversion did not vary much, but that its rate varied with the amount of the hydrogen ions added, that is, with the amount of hypochlorous acid set free. Increased concentration of the hypochlorite and a higher temperature also promote the conversion.

Hypochlorous acid is but extremely little dissociated in solution, and it is the undissociated molecule of this acid that, in the author's opinion, oxidises the hypochlorite to chlorate. The acid itself undergoes but a very slow change in aqueous solution, in the absence of other substances; if a hypochlorite is added, a rapid formation of chlorate occurs. Now the hypochlorite solution contains hypochlorite ions, and it is to a reaction between these and undissociated hypochlorous acid that the formation of the chlorate is attributed:

$$2\mathrm{HOCl} + \mathrm{Cl}\overset{-}{\mathrm{O}} = 2\overset{+}{\mathrm{H}} + 2\mathrm{C}\overset{-}{\mathrm{l}} + \mathrm{Cl}\overset{-}{\mathrm{O}}_3;\ \text{or}\ \mathrm{HOCl} + 2\mathrm{Cl}\overset{-}{\mathrm{O}} = \overset{+}{\mathrm{H}} + \mathrm{C}\overset{-}{\mathrm{l}} + \mathrm{Cl}\overset{-}{\mathrm{O}}_3.$$

The presence of an alkali chloride promotes the action, but chlorine gas is evolved at the same time; in this case, chloride ions are oxidised to chlorate by the hypochlorous acid: $6HOCl + \overset{-}{Cl} = 3HOCl + 3\overset{+}{H} + 3\overset{-}{Cl} + Cl\overset{-}{O}_3 = 3H_2O + 3Cl_2 + Cl\overset{-}{O}_3$. As the hypochlorous acid is used up, it is continuously regenerated from the hypochlorite ions of the alkali hypochlorite and the hydrogen ions of the acid added, or, failing that, of the water. So long, however, as alkali hydroxide is still in excess, abundance of hydroxyl ions are present, and these reduce the concentration of the hydrogen ions of the hypochlorous acid, uniting with them to form water; to remain in equilibrium with this diminished concentration of hydrogen ions, the concentration of the undissociated hypochlorous acid must decrease too (by dissociation and union of its hydrogen ions with the hydroxyl ions present to form water), and the amount of it that remains undissociated is too little to effect the conversion of hypochlorite into chlorate at any considerable rate. (When a solution of potassium carbonate is chlorinated, it is only after it has become half saturated, that is, after all the carbonate has been converted into hydrogen carbonate, that chlorate is formed at an appreciable rate). But if the base employed is one that yields only a small concentration of hydroxyl ions to the solution, then the concentration of the hydrogen ions is reduced to a much smaller extent, the existence of undissociated hypochlorous acid in much greater concentration is possible, and the conversion of hypochlorite to chlorate can be effected much more rapidly. It was found, in fact, that, when an approximately neutral sodium hypochlorite was mixed in separate portions with magnesium sulphate, calcium chloride, and zinc sulphate in amounts equivalent to the hypochlorite present, conversion of the latter into chlorate took place very slowly in the first case, less slowly in the second, fairly rapidly in the third, whilst, in the first case, no precipitate formed, in the second a slight precipitate of calcium hydroxide formed gradually, and in the third a dense precipitate of zinc hydroxide formed at once. In the case of the electrolysis of a calcium chloride solution, the results are complicated by the fact that the calcium hydroxide separates at the anode in very different conditions; sometimes it separates in such a form that it redissolves but slowly when the electrolysed solution is allowed to remain; in this case, a fairly rapid conversion into chlorate ensues. Sometimes only a little separates, and that in such a form that it readily dissolves; in that case, the hydroxyl ions are maintained at a comparatively high concentration in the solution, and it is found that the conversion into chlorate takes place very slowly. When chlorine is passed into water containing silver oxide in suspension, and the mixture is repeatedly shaken, silver chloride and hypochlorite are formed; if the shaking is omitted, hydrolysis of the hypochlorite ensues to some extent, and the hypochlorous acid formed, no longer neutralised by being brought continually into contact with silver oxide, effects the conversion of the silver hypochlorite into chlorate, silver chloride being precipitated.

In the case of mercuric oxide, the mercuric hypochlorite is probably hydrolysed very largely, forming undissociated hypochlorous acid; at the same time, most of the mercuric chloride which is formed is withdrawn from the solution in the form of the insoluble oxychloride, and the small amount that remains dissolved is, as is well known, dissociated to but a slight extent. The solution, therefore, is comparatively deficient in both hypochlorite and chlorine ions, there is little that the undissociated hypochlorous acid can oxidise to chlorate ions, and as is found in fact, very little chlorate is formed, the reaction being the usual method of preparing hypochlorous acid.

The hypochlorous acid used was obtained by passing chlorine into water containing freshly prepared yellow mercuric oxide in suspension, and well shaken, the vessel being immersed in water and kept in the dark. Only a trace of chlorate was formed, and the solution contained 4·8 per cent. HOCl; on distillation, about half decomposed, yielding chloric acid and chlorine, but the first fifth that passed over contained as much as 8·5 per cent. HOCl. C. F. B.

Experiments on High Strength Hypochlorite Solutions. By MAX MUSPRATT and E. SHRAPNELL SMITH (*J. Soc. Chem. Ind.*, 1898, **17**, 1096—1100. Compare Abstr., 1897, ii, 206).—In order that strong solutions of hypochlorite may be obtained by passing chlorine into sodium hydroxide solution, the following conditions must be adhered to. (1) An excess of alkali must always be present. (2) The temperature must be kept as low as possible, and should not rise above 27°. (3) The solution at starting should be of such sp. gr. as to allow the sodium chloride to settle rapidly. (4) The formation of scum must be avoided; if formed, it should be removed. (5) To obtain higher strengths than those corresponding with the amount of alkali, which experience showed could not be exceeded in the original solutions, solid sodium hydroxide must be added from time to time.

The stability of these solutions was investigated by exposing them in glass cylinders to full daylight during the summer months. The results indicate that the presence of iron in a hypochlorite has a serious influence on its stability, for it is converted into sodium ferrate which reacts with the hypochlorite, causing, not only the evolution of oxygen, but the formation of a considerable amount of chlorate. In the absence of iron, the hypochlorite is stable up to the point when sodium chloride begins to be deposited, but from that stage to a point where all the salt is deposited, it is not quite so stable, although its stability is considerable; beyond the stage where sodium chloride ceases to be deposited, absolute instability exists. In favourable circumstances, a hypochlorite can be made containing 35 per cent. by volume of available chlorine. During the investigations, crystals of sodium hypochlorite have been obtained; they contained NaOCl, 37·6, NaCl, 3·7, and water, 58·7; per cent. no chlorate was present. J. J. S.

Density and Molecular Weight of Ozone. By ALBERT LADENBURG (*Ber.*, 1899, **32**, 221—222).—A reply to the criticisms of Staedel and Gröger (this vol., ii, 150); the author agrees with their conclusion that the molecular weight of ozone cannot be determined by taking the density of a mixture of ozone and oxygen and also estimating the quantity of iodine which the mixture can set free, but argues that this conclusion has no connection with his work. J. F. T.

Ozone. By Marius Otto (*Ann. Chim. Phys.*, 1898, [vii], **13**, 77—144. Compare Abstr., 1897, ii, 139 and 207).—The various forms of ozonisers are discussed, and an apparatus described, constructed for use with alternating currents, by means of which 15 per cent. of the theoretical amount of ozone can be produced; the yield obtained from Siemens and Andreoli's ozonisers is less than 2 per cent.

Methane at ordinary temperatures is oxidised by ozone to methylic alcohol, formaldehyde, and formic acid; at 100°, the latter substances alone are obtained. Ethylene, treated with ozonised oxygen containing less than 50 milligrams of ozone per litre, yields acetaldehyde and acetic acid; neither ethylic alcohol nor glycol could be detected among the products of oxidation. Acetylene is decomposed by ozone with explosive violence, and carbon is deposited. Methylic and ethylic alcohols, when treated with ozone, yield small quantities of the corresponding aldehydes and acids. Glycol also gives aldehydic and acidic substances, but the only substance isolated was glyoxal. Glycerol furnishes similar products, but their exact nature could not be determined. The mono- and di-hydric phenols are attacked by ozone, but resinous products are obtained, except in the case of catechol, which gives a small quantity of a substance resembling purpurogallol. Isoeugenol, isosafrole, and anethoil are oxidised to vanillin, piperonal, and anisaldehyde respectively. Aniline is oxidised to quinone and azobenzene, and paratoluidine to parazotoluene.

G. T. M.

Combustion of Mixtures of Hydrogen and Oxygenated Gases. By Marcellin P. E. Berthelot (*Ann. Chim. Phys.*, 1898, [vii], **14**, 167—170).—When hydrogen, mixed with carbonic anhydride or sulphurous anhydride, is exploded with excess of oxygen, the hydrogen is oxidised to water without affecting either of the other compounds. If a mixture of hydrogen and carbonic anhydride is ignited in a vessel open to the air, a portion of the compound gas is reduced to carbonic oxide; a mixture of hydrogen and sulphurous anhydride similarly treated yields small quantities of hydrogen sulphide and free sulphur. The temperature produced by the combustion of the hydrogen causes dissociation of the oxygenated gas, the carbonic anhydride giving rise to carbonic oxide and oxygen, the sulphurous anhydride to sulphur and oxygen; the oxygen unites with hydrogen, whilst a portion of the sulphur combines with this element to form hydrogen sulphide. These products of combustion, being cooled to a temperature below their ignition point before diffusing into a part of the system containing free oxygen, are found in the residual mixture at the close of the experiment. G. T. M.

Action of Hydrogen on Sulphurous Anhydride. By Marcellin P. E. Berthelot (*Ann. Chim. Phys.*, 1898, [vii], **14**, 289—293. Compare preceding abstract).—Hydrogen and sulphurous anhydride, whether dry or moist, have no action on one another at the ordinary temperature; the dry gases react at a red heat, water and sulphur being produced; if the temperature is not too high, hydrogen sulphide is also obtained. The paper concludes with a discussion of the nascent state from a thermochemical standpoint. The reaction $SO_2 + 3H_2 = 2H_2O + H_2S$ is exothermic, but the heat developed is not sufficient to determine the change at the ordinary temperature, but if the heat developed by the action of zinc on dilute sulphurous acid be added, the action takes place even in the cold. G. T. M.

Action of Sulphuric Acid on Metals. By **Marcellin P. E. Berthelot** (*Ann. Chim. Phys.*, 1898, [vii], 14, 176—204).—Hydrogen is evolved when zinc is treated with concentrated sulphuric acid in the cold; at 180°, hydrogen and sulphurous anhydride are evolved, and zinc sulphate is produced; there is no formation of zinc sulphide. Free hydrogen reduces concentrated sulphuric acid to sulphurous anhydride (Abstr., 1898, ii, 160), but not to hydrogen sulphide; the latter gas is produced by the direct action of zinc on moderately concentrated sulphuric acid (78 per cent.) and on sulphurous, hyposulphurous, and polythionic acids; this action is usually attributed to nascent hydrogen. When treated with cold dilute sulphuric acid, zinc sulphide evolves hydrogen sulphide; with hot concentrated acid sulphurous anhydride is produced. Hydrogen sulphide is decomposed by sulphuric acid of concentration greater than that corresponding with $H_2SO_4,2H_2O$, the products being sulphur, sulphurous, and polythionic acids. Iron and cadmium are attacked by the concentrated acid in the cold, and hydrogen is evolved, but at 160°, the gas generated consists chiefly of sulphurous anhydride. Nickel is only very slowly attacked by cold concentrated sulphuric acid, owing to the formation of a protective layer of sulphide. Sulphurous acid acts on these metals, forming the sulphides and sulphur.

Lead is not acted on by dilute sulphuric acid in the cold, and only slightly at 100°; with the concentrated acid, the reaction is very slow, owing to the deposition of sulphate and sulphide. If dilute sulphuric acid be distilled in the presence of lead so that its concentration gradually increases, hydrogen sulphide is evolved, and sulphur and lead sulphide are produced. Lead sulphide is decomposed by the concentrated acid, hydrogen sulphide and sulphurous anhydride being successively evolved; with 60 per cent. acid, the formation of the latter gas is not noticeable. Lead is only superficially blackened by the action of sulphurous acid, and is not attacked by formic and acetic acids. An account of the action of sulphuric acid on mercury has already appeared (Abstr., 1898, ii, 164). Silver, left in contact with the cold concentrated acid for two months, is slightly blackened; at 100°, sulphurous anhydride is evolved. Silver sulphide is only attacked by the concentrated acid at high temperatures, sulphurous anhydride being liberated. Copper placed in cold concentrated sulphuric acid produces an evolution of sulphurous anhydride, and the metal becomes coated with a layer of sulphide and sulphate; a similar result is obtained at 100°; the dilute acid has no action even at this temperature. Copper, heated at 160—170° with a mixture of equal parts by weight of sulphuric acid and water, dissolves, and sulphurous anhydride is evolved; the liquid, when poured into cold water, yields a crystalline precipitate, consisting of an unstable, cuprous salt, which is formed at a certain stage in this reaction. Copper placed in sulphurous acid becomes superficially coated with sulphide and a red substance, probably a cuprous compound; the metal appears to be attacked by dilute hydrochloric acid at 100°, although no appreciable volume of gas is evolved. G. T. M.

Metathetic Reactions between certain Salts in Solution in Liquid Ammonia. By EDWARD C. FRANKLIN and C. A. KRAUS (*Amer. Chem. J.*, 1899, **21**, 1—8. Compare this vol., ii, 208).—Anhydrous liquid ammonia resembles water in its power of inducing electrolytic dissociation, and of acting as a general solvent. The authors have examined the interaction of various salts in this solvent, and find that salts whose ions can by interchange form compounds insoluble in the medium, do react in this sense. The nitrates of 16 common metals were used to furnish the metallic ions, whilst the acidic ions were supplied in the form of ammonium salts. The experiments were made in vacuum jacketed tubes. Ammonium chloride precipitates most of the metallic radicles as chlorides, those chlorides which, by direct experiment, are found to be least soluble in liquid ammonia being precipitated most rapidly and completely. The bromides are more soluble in this solvent than the chlorides, and are precipitated more slowly; only barium and strontium give immediate precipitates with ammonium iodide. All the metallic radicles, except the alkalis, yield precipitates with ammonium sulphide; in the case of magnesium, the precipitate has a composition corresponding with $2MgS,(NH_4)_2S$, combined with 9 or 10 molecules of ammonia of crystallisation. Ammonium chromate gives precipitates with all the metallic radicles, except lithium and sodium, and ammonium borate with all but these two alkalis, together with potassium. The results are summarised in tabular form at the end of the paper. G. T. M.

Properties of Liquid Ammonia. By EDWARD C. FRANKLIN and C. A. KRAUS (*Amer. Chem. J.*, 1899, **21**, 8—14).—A discussion of the close analogy existing between water and liquid ammonia. Solutions of salts in the latter solvent conduct the electric current almost as well as their aqueous solutions (Cady, Abstr., 1898, ii, 203), and metathetic reactions of a similar nature occur in both media (see preceding abstract). The specific heat, boiling point, and heat of volatilisation of liquid ammonia are abnormally high, like the corresponding properties of water. The molecular elevation of the boiling point of ammonia is smaller than that of any other solvent; its association constant approaches that of water, and exceeds those of the alcohols. Liquid ammonia differs from water in its inability to dissolve the sulphates and sulphites, the alkali carbonates, phosphates, and oxalates, and the hydroxides of the alkali and alkaline earth metals; in its solvent action on many organic substances, it resembles alcohol; it has no point of maximum density, and solid ammonia is not specifically lighter than the liquid at the freezing point. Its dielectric constant is lower than that of water, and, if Nernst's

hypothesis holds, it indicates that the electrolytic dissociation of salts dissolved in this solvent should be less than in aqueous solutions.
G. T. M.

Hydroxylamine. By SIMEON M. TANATAR (*Ber.*, 1899, **32**, 241—244).—When a 10 per cent. solution of hydroxylamine hydrochloride or sulphate is saturated with sulphurous anhydride, kept overnight, and then evaporated to dryness on a water-bath, it is converted completely into ammonium sulphate; hydrazine sulphate is not attacked by sulphurous anhydride even on heating at 100° in a sealed tube. When hydroxylamine hydrochloride is warmed with phosphorus pentachloride, reaction takes place, and on decomposing the product with water and evaporating, it is found that the hydroxylamine has been converted into ammonium chloride; the author explains the action as due to the formation of $NH_2Cl = NH,HCl$, and then $3NH = NH_3 + N_2$. By the action of hydrogen peroxide, hydroxylamine hydrochloride is oxidised directly to nitrogen and nitric acid, and no ammonia is produced; when the oxidation is carried out in presence of sodium hydroxide, the chief product is nitric acid, together with a small amount of nitrogen. T. M. L.

Hydroxylamine. By FRITZ RASCHIG (*Ber.*, 1899, **32**, 394).—With regard to Tanatar's explanation of the action of sulphurous anhydride on aqueous hydroxylamine hydrochloride (preceding abstract), the author points out that, in this change, hydroxylamine does not act as an oxidising agent, but simply condenses with the sulphurous anhydride, forming sulphamic acid (compare Abstr., 1887, 549), which subsequently undergoes hydrolysis. W. A. D.

Constitution of Hydroxylamine. By JULIUS W. BRÜHL (*Ber.*, 1899, **32**, 507—508).—The author criticises the views of Tanatar regarding the constitution of hydroxylamine (compare preceding abstracts). M. O. F.

Heat Developed by the Action of Water on Excess of Nitric Acid. By MARCELLIN P. E. BERTHELOT (*Ann. Chim. Phys.*, 1898, [vii], **14**, 207—208).—The heat developed by the successive additions of small quantities of water (1 to 3 mols.) to a considerable excess (31·44 mols.) of nitric acid was determined with the following results: 1st, $H_2O = +4·54$ Cal.; 2nd, $H_2O = +4·55$ Cal.; 3rd, $H_2O = +4·59$ Cal G. T. M.

Action of Aqueous Alcoholic Alkalis on Phosphorus. By AUGUST MICHAELIS and M. PITSCH (*Ber.*, 1899, **32**, 337—339).—Phosphorus gradually dissolves in a mixture of 1 volume of 10 per cent. sodium hydroxide solution and 2 volumes of alcohol with the production of a dark red solution, nearly pure hydrogen being eliminated during the process. If the solution be acidified with dilute hydrochloric acid, a greenish-yellow precipitate is produced which is none other than the phosphorus suboxide, P_4O, first obtained by Le Verrier. The suboxide is insoluble in all solvents except aqueous alcoholic alkali; this solution is not stable, but decomposes when left, or on warming, with evolution of hydrogen phosphide and hydrogen. J. F. T.

Metallic Phosphides. By ALBERT GRANGER (*Ann. Chim. Phys.*, 1898, [vii], **14**, 5—90. Compare Abstr., 1892, 410, 1398; 1893, ii, 526; 1895, ii, 392; 1896, ii, 476, 602, 650; 1897, ii, 215, 265, 323, 371, 453; 1898, ii, 474).—This paper contains an historical introduction and an account of work already published. G. T. M.

Preparation of Arsenic Hydride. By A. P. SAUNDERS (*Chem. News*, 1899, **79**, 66—67).—Powdered arsenic, mixed with a small quantity of freshly-cut pieces of sodium, is gently heated in a porcelain boat resting on a strip of asbestos in a piece of wide combustion tube with the ends loosely plugged; when the glass begins to redden, reaction suddenly takes place, and, if the tube is not broken by the violence of the reaction, it is set aside to cool. The hydrogen arsenide is obtained by treating the sodium arsenide with dilute hydrochloric or sulphuric acid. D. A. L.

Action of Sulphuric Acid on Carbon at Low Temperatures. By MARCELLIN P. E. BERTHELOT (*Ann. Chim. Phys.*, 1898, [vii], **14**, 206—207).—Graphite and wood charcoal are not acted on by concentrated sulphuric acid at the ordinary temperature; at 100°, the former remains unaltered whilst the latter produces a slight evolution of sulphurous and carbonic anhydrides without any appreciable quantity of carbonic oxide. G. T. M.

Chemical Equilibrium between Hydrogen and the Oxides of Carbon. By MARCELLIN P. E. BERTHELOT (*Ann. Chim. Phys*, 1898, [vii], **14**, 170—176).—Carbonic anhydride, when heated at high temperatures, undergoes partial dissociation into carbonic oxide and oxygen. In the presence of carbon or hydrogen, the oxygen thus liberated is employed in oxidising this element, and further dissociation of carbonic anhydride must take place in order to preserve the equilibrium. Water vapour at a similar temperature also undergoes partial dissociation into its components. When a mixture consisting of carbonic anhydride and hydrogen is raised to a high temperature, the state of equilibrium is established, not between the binary systems $(CO_2 + H_2)$ and $(CO + H_2O)$, but between the more complicated system $\{(n - a)CO_2 + a(CO + O)\}$ resulting from the partial dissociation of carbonic anhydride and that produced by the partial dissociation of steam $\{(m - \beta)H_2O + \beta(H_2 + O)\}$, and a further complication results from the dissociation of carbonic oxide which reacts in the following sense, $\{pCO = (p - 2)CO + CO_2 + C\}$. This explanation is based on the observed behaviour of these compounds at high temperatures, each of them dissociating in the manner indicated, independently of the presence of the others. The case of mixtures which are being conveyed from the heated space to a cooler zone, and are thus exposed to rapid changes of temperature, must also be considered, since it so frequently obtains in practice.

It follows from this that the mathematical explanations of these phenomena hitherto proposed are quite inadequate, since they assume the existence of hypothetical systems which are never produced under experimental conditions. G. T. M.

Decomposition of Carbonic Oxide in presence of Ferric Oxide. By O. BOUDOUARD (*Compt. rend.*, 1899, **128**, 98—101).—When finely divided ferric oxide is heated at 445° in sealed tubes with purified and dried carbonic oxide, the decomposition of the latter is a function of the time and of the quantity of ferric oxide present. The quantity of carbonic anhydride formed, increases regularly, and eventually the decomposition is complete. Similar experiments are being made with cobalt and nickel oxides at 445° and with all three oxides at higher temperatures. C. H. B.

Reaction with Carbon Oxysulphide. By MARCELLIN P. E. BERTHELOT (*Ann. Chim. Phys.*, 1898, [vii], **14**, 205).—Carbon oxysulphide is slowly decomposed by an acid solution of cuprous chloride in accordance with the equation, $COS + 2CuCl + H_2O = CO_2 + 2HCl + Cu_2S$. G. T. M.

A New Gas [Etherion]. By CHARLES F. BRUSH (*J. Amer. Chem. Soc.*, 1898, **20**, 899—911).—During experiments on the thermal conductivity of gases at pressures of a few millionths of an atmosphere, the author found that heated glass evolves a gas partially reabsorbed on cooling, which is characterised by an exceedingly high conductivity, probably over 100 times that of hydrogen. As the thermal conductivities appear to be in the ratio of the molecular velocities, and hence in the inverse ratio of the square roots of the densities, the author considers the new gas possesses a density of below 0·0001, compared with hydrogen, and that, owing to its great molecular velocity, it is not confined to the atmosphere, but must extend to interstellar space. The name *etherion* is given to it, or to its lightest constituent, if a mixture. L. M. J.

NOTE.—Sir William Crookes (*Chem. News*, **78**, 221) considers it more probable that 'etherion' is water vapour at low pressure than that it is an elementary gas. L. M. J.

Hydrate of Lithium-bromocuprite. By N. S. KURNAKOFF and A. A. SEMENTSCHENKO (*Zeit. anorg. Chem.*, 1899, **19**, 335—338).—*Lithium-bromocuprite*, $CuBr_2,2LiBr + 6H_2O$, obtained by evaporating an aqueous solution of its constituents on the water-bath, crystallises in black, prismatic needles having a bronze lustre; in thin layers, they are reddish-brown by transmitted light. It is extremely hygroscopic, does not easily give up its water of crystallisation, and is not dehydrated by remaining over sulphuric acid. This behaviour, in conjunction with the colour, points to the conclusion that the salt contains the hydrate $LiBr + 3H_2O$, as expressed in the formula $CuBr_2(LiBr + 3H_2O)_2$.

The blue salt, $(CuCl_2 + 2H_2O),2KCl$, contains the water combined with the $CuCl_2$, and by substituting bromine for chlorine the anhydrous salt $CuBr_2,KBr$, is obtained; this is in accordance with the fact that for copper and other metals of the eighth group of the periodic system, the hydrates of the bromo-salts are less stable than those of the chloro-salts. The same relation holds good for the heat of solution of the haloid salts. The instability of the hydrate of cupric bromide has undoubtedly an effect on the composition of the double salt, $CuBr_2,KBr$, which contains no water of crystallisation, and the author points out that a consideration of the colour and the stability of the hydrates gives an insight into the position of the water in the complex molecule of a haloid double salt as expressed in the formulæ $CuX_2,(LiX + nH_2O)_m$ and $(CuCl_2 + 2H_2O),2KCl$. E. C. R.

Action of Alkali Chlorides on Silver. By MARCELLIN P. E. BERTHELOT (*Ann. Chim. Phys.*, 1898, [vii], **14**, 205—206).—Silver in the form of sheets, when immersed in solutions of the alkali chlorides contained in stoppered vessels, is slowly attacked with the formation of double chlorides, the crystals of which adhere to the surface of the metal. The vessels were protected from bright sunlight and allowed to remain for four years; it was found that the sheet immersed in potassium chloride had preserved its bright surface, whilst that in sodium chloride had become tarnished and was of a deep violet colour. G. T. M.

Solubility of Silver Bromide and Chloride in Sodium Thiosulphate Solutions. By THEODORE W. RICHARDS and HENRY B. FABER (*Amer. Chem. J.*, 1899, **21**, 167—172).—Solutions of sodium thiosulphate of varying strengths are saturated with silver bromide and the amount of silver in solution estimated by means of hydrogen sulphide; the results show that the ratio of the bromide to the thiosulphate increases with increase in the concentration of the thiosulphate. The solubility of silver chloride in a 20 per cent. solution of thiosulphate is less than that of the bromide. The addition of silver bromide to a thiosulphate solution raises its freezing point; this result must be due to a diminution of the total number of molecules present, and appears to favour Barth's conclusion as to the formation of a complex ion; the following double salts: $Ag_2S_2O_3,2Na_2S_2O_3 + 2H_2O$ and $Ag_2S_2O_3,Na_2S_2O_3 + H_2O$ are known in the solid state. Beyond a certain limit, the addition of bromide produces no further rise in the freezing point. G. T. M.

Calcium Arsenide. By PAUL LEBEAU (*Compt. rend.*, 1899, **128**, 95—98).—Calcium arsenide, As_2Ca_3, identical in composition with that formed by the direct union of its constituents, is obtained by heating 100 parts of calcium arsenate and 31 parts of petroleum coke in a carbon crucible in an electric furnace for two or three minutes, using a current of 950—1000 ampères and 45 volts. It forms a crystalline mass, which is transparent and reddish-brown in small fragments, has a sp. gr. = 2·5 at 15°, and in hardness lies between calcite and glass. It is not affected by dry air or oxygen at the ordinary temperature, but when heated burns brilliantly, especially in oxygen, with formation of the arsenate if the oxygen is in large excess, but with sublimation of arsenious anhydride and even of arsenic if it is not. Sulphur attacks the arsenide at a dull-red heat, but boron and carbon have no action at 1000°; in the electrical furnace, however, carbon rapidly and completely decomposes it. In contact with water, the arsenide is completely converted into hydrogen arsenide and calcium hydroxide, without any liberation of hydrogen or separation of a solid brown arsenide as in the action of water on the arsenide obtained by direct synthesis. Moist air somewhat quickly decomposes the arsenide, and it is attacked at a dull red heat by hydrogen sulphide, by the gaseous hydracids and various oxidising agents. The arsenide reduces sulphuric acid in the cold, and fuming nitric acid on gently heating; it also decomposes many metallic salts. C. H. B.

Action of Calcium Sulphate on Halogen Alkali Salts. By ALFRED DITTE (*Ann. Chim. Phys.*, 1898, [vii], **14**, 294—311).—A detailed account of work already published (Abstr., 1898, ii, 510—511). G. T. M.

Constitution of Hydraulic Cements. By ORAZIO REBUFFAT (*Gazzetta*, 1898, **28**, ii, 209—247).—The author summarises recent contributions to the chemistry of hydraulic cements, showing how the conclusions arrived at by different workers are in agreement or otherwise with his own. He has examined seven samples of different cements, determining the proportions of free lime and of calcium silicate and aluminate before and after setting, and his results lead to the following conclusions. After setting, hydraulic cements all have the same qualitative composition, being mixtures of calcium hydroxide, hydrated calcium orthosilicate, $2(SiO_2,2CaO),H_2O$, and calcium aluminate with small quantities of inert slaggy matter. Besides these, in cements rich in silica, there is doubtless present some non-hydrated calcium metasilicate, (SiO_2,CaO), which reacts on the aluminate, forming double silicates of calcium and aluminium; the production of these double compounds has an important bearing on the great resistance to sea-water possessed by such cements. With regard to their composition before setting, the author divides hydraulic cements into two classes. (1) Hydraulic lime and quick-setting cements, which are of a non-crystalline and compact nature, and result from the mixing of aluminate with calcium orthosilicate and in some cases also with lime. (2) Portland and siliceous cements, consisting of a crystalline compound of SiO_2,CaO with varying proportions of CaO and a calcium aluminate. The author is of opinion that the hardening of cements is determined mainly by the hydration of the calcium orthosilicate forming $2(SiO_2,2CaO)+H_2O$, and incidentally also by the hydration of the calcium aluminate. T. H. P.

Displacement of Metals by Magnesium. By EDWARD G. BRYANT (*Chem. News*, 1899, **79**, 75—76).—In hot, cold, weak, or strong zinc sulphate solution, only little more than 50 per cent. of the metallic zinc is displaced by magnesium; gas is evolved, and the precipitate formed consists of zinc, zinc oxide, and magnesium oxide. In lead nitrate, chloride, or acetate, hydrogen is evolved in increasing quantities as reaction progresses, and lead is reduced by the magnesium; in some cases, the lead is not oxidised while covered with the liquid, magnesium being present in excess. Silver is also precipitated from its solution by magnesium with progressive evolution of hydrogen. D. A. L.

Red Potassium Copper Chloride. By MAX GRÖGER (*Zeit. anorg. Chem.*, 1899, **19**, 328—331).—Potassium copper chloride, $KCl,CuCl_2$, is obtained as a red powder by shaking a mixture of copper chloride, finely powdered potassium chloride, and concentrated hydrochloric acid in a closed vessel, provided that the ratio of potassium chloride to copper chloride does not exceed that required by the above formula. If dilute solutions are employed, the compound is obtained in red needles. It is easily soluble in strong hydrochloric acid, and when hydrochloric acid is used to wash the salt, it extracts the copper chloride in preference to the potassium chloride. On exposure to moist air, the salt rapidly becomes green, and yields a mixture of cupric chloride with the blue salt, $CuCl_2,2KCl + 2H_2O$. E. C. R.

Potable Waters which have flowed through Lead Pipes. By Ubaldo Antony (*Gazzetta*, 1898, **28**, ii, 135—139. Compare Abstr., 1897, ii, 36).—In continuation of his previous work, the author gives the results of experiments made to determine the action on lead of waters containing magnesium sulphate, magnesium hydrogen carbonate, calcium chloride, sodium hydrogen carbonate, with or without alkali chlorides or sulphates, and under different conditions of aëration. The experimental conditions and the method of determination of the lead are the same as those already described (*loc. cit.*, and Abstr., 1895, ii, 549).

The results are summarised in the following table, to which, for the sake of comparison, are added those of the two former series. The numbers given are grams of lead dissolved in 100 litres of liquid :—

Series.		A.	B.	C.	D.	E.	F.	G.
Non-aërated	1. Alone	8·19	2·45	6·83	3·28	1·77	1·80	1·23
	2. With chlorides.	1·36	2·05	5·46	0·99	1·70	1·70	1·34
	3. With sulphates.	3·41	2·18	4·78	1·32	1·36	1·40	0·95
Aërated	1. Alone	12·98	3·14	6·83	1·65	1·70	1·60	0·34
	2. With chlorides.	2·75	3·41	6·57	1·71	1·16	0·90	0·47
	3. With sulphates.	6·83	3·32	5·87	1·71	1·68	0·80	1·16
Continuously aërated	1. Alone	8·19	2·63	3·41	1·58	0·75	1·15	1·16
	2. With chlorides.	0·68	2·35	3·55	1·25	0·54	0·61	0·95
	3. With sulphates.	2·05	2·05	3·69	0·46	0·51	1·02	1·45
With continuous aëration and passage of carbonic anhydride	1. Alone	4·09	5·70	1·35	0·72	0·75	0·88	0·88
	2. With chlorides.	4·09	3·40	1·50	1·12	1·29	0·68	0·68
	3. With sulphates.	1·84	3·16	1·77	0·99	0·89	0·68	0·81

The column A refers to distilled water; B, to water containing per litre 0·04 gram of CaO, as calcium hydrogen carbonate, possessing therefore 4° of temporary hardness; C, to water containing 0·232 gram of $CaSO_4$ per litre, that is, with a permanent hardness of 9·5°; D, to water with 0·38 gram of $MgSO_4$ per litre, corresponding with 9·5° of permanent hardness; E, to water containing 0·195 gram of $Mg(HCO_3)_2$ per litre, that is, having 4° of temporary hardness; F, to water containing 0·046 gram of $CaCl_2$ per litre, and G, to water with 5·4 gram of $NaHCO_3$ per litre, corresponding with the quantity present in the waters of Vichy (Hôpital), which are among the most alkaline known.

The author concludes that ordinary drinking waters always dissolve a larger or smaller quantity of lead, and that with temporarily hard waters the proportion of lead is much less than with permanently hard waters; this is doubtless due to the insoluble incrustation formed in the former case. T. H. P.

Separation of the Cerite Metals. By CARL VON SCHÉELE (*Ber.*, 1899, **32**, 409—417).—Pure lanthana can be readily obtained from a mixture of the rare earths by converting these into the nitrates, and crystallising the product from water containing sufficient ammonium nitrate to form the double salts of the type $M(NO_3)_3 + 2NH_4NO_3$; after 8 crystallisations, the lanthanum double salt is nearly pure, but contains small quantities of cerium, which can be removed by precipitating the double salt as oxalate, dissolving the latter in nitric acid, and treating the nitrate thus obtained by Debray's method. The separation of praseodymium and neodymium from one another and from the metals usually accompanying them is dealt with at length; for details, the original paper should be consulted.

W. A. D.

Peroxidation of Cerium in presence of Alkali Carbonates. By ANDRÉ JOB (*Compt. rend.*, 1899, **128**, 178—181).—Ceric salts are more soluble than cerous salts in solutions of alkali carbonates, and the solubility is still further increased if they are peroxidised. If, however, an excess of hydrogen peroxide is added, the solubility is reduced and a precipitate forms, the nature of which has not yet been ascertained. In order to obtain a concentrated solution of cerium peroxide, hydrogen peroxide and ceric ammonium nitrate, in molecular proportion, are added successively to a concentrated aqueous solution of potassium carbonate, and the solution is agitated; a limpid, deep-coloured liquid is thus obtained, and as much as 40 grams of cerium dioxide may be added per litre if 280 grams of alkali carbonate are also present. Potassium hydrogen carbonate may be used in place of the normal carbonate, but then the solubility of the cerium salt is less.

If to the solution prepared in the manner just described, hydrogen peroxide is added in slight excess but not in sufficient quantity to produce a precipitate, and the solution is allowed to remain at the ordinary temperature, it at first loses some oxygen, but is afterwards quite stable, the quantity of available oxygen in it corresponding exactly with that required by the formula CeO_3.

The oxidising power of the solution can be determined by means of a standard solution of ferrous sodium pyrophosphate, the excess being determined by means of permanganate solution. If a small quantity of potassium hydrogen carbonate is added to the liquid, the appearance of a yellow colour indicates that the ferrous salt is completely oxidised and the oxidation of the cerous salt is beginning; if the addition of permanganate is continued, a change of colour from yellow to brown indicates that peroxidation of the cerium has commenced.

Ceric salts do not absorb oxygen from the air, but if a solution of a cerous salt containing also an alkali carbonate is exposed to the air, it is first oxidised to a ceric salt and then continues to absorb oxygen up to a limit that depends on the strength of the solution.

C. H. B.

Atomic Weights of Praseodymium and Neodymium. By Harry C. Jones (*Zeit. anorg. Chem.*, 1899, **19**, 339—341).—A comparison of the independent results obtained by Brauner (Proc., 1898, 70), by Schéele (Abstr., 1898, ii, 519), and by the author (Abstr., 1898, ii, 429), shows that the atomic weights attributed by Auer von Welsbach to praseodymium and neodymium, 143·6 and 140·8 respectively, should be reversed.

E. C. R.

Aluminium. By Alfred Ditte (*Compt. rend.*, 1899, **128**, 195—201).—If a strip of aluminium is partly immersed in a solution of sodium chloride acidified with acetic acid, which is capable of dissolving the metal (this vol., ii, 225), the action is far more rapid at the surface of the liquid than at any other point, because the atmospheric oxygen takes part in the reaction. Other acids may be used instead of acetic acid, with similar results, and even carbonic anhydride is active. If a plate of aluminium is partially immersed in a solution of 30 grams of pure sodium chloride in 1000 c.c. of water, which of itself has no action on aluminium, and air is allowed free access to the surface of the liquid, the metal is somewhat rapidly attacked at that surface and becomes coated with gelatinous aluminium hydroxide in which, after a time, opaque, white spots appear and increase in size. At the same time, the solution becomes alkaline to litmus. The oxygen dissolved in the liquid converts a small quantity of the aluminium into oxide, but since the decomposition of sodium chloride by aluminium oxide would be strongly endothermic, the carbonic anhydride of the air must take part in the change, the reaction $Al_2O_3 + 6NaCl$ diss. $+ 3CO_2$ diss. $= Al_2Cl_6$ diss. $+ 3Na_2CO_3$ diss. developing +33·1 Cal. The sodium carbonate thus formed is able to attack the aluminium with formation of sodium hydrogen carbonate and sodium aluminate and development of a considerable amount of heat; the aluminate is then decomposed by water into aluminium hydroxide and sodium hydroxide, which can produce further reactions. Part of the aluminium hydroxide, however, gradually changes to the crystallised and insoluble form, and is thus removed from the sphere of action. Carbonic anhydride can also decompose the aluminate with formation of the crystallised hydroxide and sodium carbonate, or, under certain conditions, of a double sodium aluminium carbonate; the latter may be decomposed by the sodium hydroxide present in the liquid and will yield sodium carbonate and crystallised aluminium hydroxide. The general character of the reactions is independent of the proportion of sodium chloride present, but is slower the more dilute the solutions; even the small proportion of the salt present in river waters is sufficient, in conjunction with atmospheric oxygen and carbonic anhydride, to set up progressive action on the aluminium.

With sea water, the reactions are similar, the calcium and magnesium chlorides and the sodium bromide behaving in the same way as sodium chloride.

If a small quantity of water containing a soluble chloride or bromide is allowed to fall on a sheet of aluminium, the metal is attacked in the general manner already described; if the salt is not hygroscopic, the attack ceases when the salt and the products become dry, but if the salt is hygroscopic, like magnesium chloride, or if the atmosphere is very moist, the action will continue until the corrosion extends through even a comparatively thick block of aluminium. C. H. B.

Constitution of Cobalt, Chromium, and Rhodium Bases. By Sofus M. Jörgensen (*Zeit. anorg. Chem.*, 1899, **19**, 109—157).—A discussion of the relative merits of the theories propounded by the author and by Werner with regard to the constitution of these compounds. E. C. R.

Carbides of Iron and other Metals in Metallurgical Products. By Adolphe Carnot and Goutal (*Compt. rend.*, 1899, **128**, 207—211).—Treatment of ferrotungsten, ferromanganese, &c., by dilute acids or other solvents in the usual way has enabled the authors to isolate several double carbides in addition to those previously described. From tungsten steel containing 2·0 to 2·2 per cent. of carbon and 6·1 to 7·8 per cent. of tungsten, they obtained the carbide Fe_3C,WC; from molybdenum steel containing 1·7 to 2·3 per cent. of carbon, the carbide Fe_3C,Mo_2C, previously prepared by Williams in the electric furnace. Ferromanganese containing more than 74 per cent. of manganese yields the carbide $Fe_3C,4Mn_3C$; that with 74 to 60 per cent. of manganese yields the carbide $Fe_3C,2Mn_3C$; that with 60 to 30 per cent. of manganese the carbide $2Fe_3C,Mn_3C$. The last carbide sometimes crystallises in large plates during the cooling of blocks of the ferromanganese. C. H. B.

Arsenates of Iron. By Hermann Metzke (*Zeit. anorg. Chem.*, 1899, **19**, 457—478).—The method employed for the analysis of these compounds is as follows. The arsenic is precipitated from a solution of the iron arsenate, strongly acidified with hydrochloric acid, by hydrogen sulphide under pressure, the precipitate of sulphur and arsenic sulphide is cautiously oxidised with fuming nitric acid at 50°, and the solution evaporated on the water-bath. The residue, dissolved in water and ammonia so that a 2·5 per cent. ammonia solution is obtained, is precipitated with magnesia mixture, absolute alcohol added, and the whole allowed to remain 48 hours. The precipitate is then washed with a mixture of 2·5 per cent. ammonia (250 c.c.), with absolute alcohol (100 c.c.), dissolved in dilute nitric acid, and evaporated to dryness in a porcelain crucible, then heated at 120° and finally to bright redness over a strong burner until a constant weight is obtained. Accurate results are obtained.

Ferric arsenate, Fe_2O_3,As_2O_5, is formed under varying conditions by the action of 1 mol. of iron ammonium alum on 2—4 mols. of disodium arsenate. The appearance of the precipitate varies with the proportion of the salts employed; when a small quantity of the arsenate is added to the alum solution, a white precipitate is obtained, whilst on adding the alum solution to the arsenate the precipitate is brownish; when the two salts are employed in equal proportions, a yellow precipitate is formed. The white precipitate turns yellow and finally brownish when washed with water. According to the conditions under which they are formed, the precipitates contain small quantities of basic or acid ferric arsenates, and always contain small quantities of ammonium and sodium arsenates. In the presence of a large excess either of disodium arsenate or of iron ammonium alum, a mixture is obtained consisting mainly of the basic ferric arsenate, $3Fe_2O_3,2As_2O_3$. Ferric arsenate, which is a bright yellow powder, insoluble in water, is slowly decomposed by cold water, more quickly by hot water, and is soluble in hydrochloric, sulphuric, nitric, dilute arsenic, and phosphoric acids; the solution in the last two acids decomposes when boiled and diluted. Neutral and acid ferric arsenates are quickly and completely dissolved by concentrated ammonia, yielding a blood-red solution; the basic ferric arsenates, however, are not. Yellow ammoniacal solutions are obtained in the presence of large quantities of disodium arsenate and ammonium chloride. These arsenates are not decomposed by a solution of silver nitrate, are quickly decomposed by solutions of ammonium and sodium acetates, and give the reaction of ferric salts with potassium ferrocyanide and thiocyanate only in strongly acid solutions, and never in ammoniacal solutions. Cold concentrated potassium hydroxide precipitates ferric hydroxide from the neutral ferric arsenate, but only an incomplete decomposition takes place when a hydrochloric acid solution of the arsenate is boiled with potassium hydroxide.

Tetrabasic ferric arsenates, $4Fe_2O_3,3As_2O_5$, approaching in composition that of pharmacosiderite, but containing varying quantities of water and small quantities of sodium and ammonium salts, are obtained by heating the preceding salt with water in a sealed tube at 200°, by boiling it with a solution of ammonium acetate acidified with acetic acid, and by oxidising with hydrogen peroxide, the white precipitate obtained by adding ferrous sulphate to sodium dihydrogen arsenate in molecular proportions.

Arsenates having a similar composition to scorodite, $Fe_2O_3,As_2O_5 + 4H_2O$, and differing from it only in the quantity of water which they contain, are obtained in the following manner:—(1) By heating the acid arsenate, $Fe_2O_3,3As_2O_5 + 17H_2O$, with arsenic acid, water, and hydrogen peroxide in a sealed tube at 170° for 14 days, whereby a compound crystallising with $1H_2O$ in yellowish-green, rhombic forms, and mixed with a small quantity of scorodite, is obtained; (2) by heating normal ferric arsenate in a similar manner, whereby a crystalline powder, with $2H_2O$, is obtained; (3) by heating ferric arsenate with water and arsenic acid in a sealed tube at 80° for 4 days, and (4) by prolonged evaporation of a solution of ferric arsenate acidified with hydrochloric acid. These salts are not altered by boiling water, sulphuric and nitric acids, are sparingly soluble in dilute, easily so in concentrated, hydrochloric acid, dissolve partially in ammonia giving a blood-red solution, and are completely decomposed by potassium hydroxide.

The *arsenate*, $2Fe_2O_3,3As_2O_5 + 22{\cdot}5H_2O$, is obtained by dissolving ferric arsenate, Fe_2O_3,As_2O_5, in arsenic acid and water and precipitating the filtered solution with alcohol; the white precipitate must be quickly washed with alcohol (98 per cent.) and dried by pressing between filter paper. It dissolves easily in acids, forming a yellow solution, and in ammonia, a red solution. The white acid compound obtained by the action of sodium hydrogen arsenate on iron ammonium alum is quickly decomposed when washed with water, dilute alcohol, or glycerol; it is not altered, however, by strong alcohol or ether, but these solvents do not wash out the impurities in the mother liquor, so that it cannot be obtained pure.

Ferric ortharsenate, $Fe_2O_3,3As_2O_5 + 16{\cdot}7H_2O$, is obtained as a white powder by adding dry tetrabasic ferric arsenate to a syrupy solution of arsenic acid and washing the product with alcohol; it is quickly decomposed by water, and dissolves in acid with a yellow, and in ammonia with a red, coloration. E. C. R.

Hydrated Blue Molybdenum Oxide. By G. Marchetti (*Zeit. anorg. Chem.*, 1899, **19**, 391—393).— Molybdenum oxide, $Mo_3O_8 + 5H_2O$, is obtained by dissolving molybdenum in strong aqua regia, and after all the nitric acid has been expelled by evaporating the solution on the water-bath, with the addition of hydrochloric acid, the diluted, filtered solution is reduced by means of an electric current. A dark blue liquid is obtained from which the acid crystallises in lustrous, nearly black, triclinic crystals; it is fairly easily soluble in water, and the solution does not give a precipitate on the addition of ammonium chloride. The cryoscopic determinations show that the molecule is neither split into ions nor polymerised in aqueous solution. E. C. R.

Hydrate of Titanium Trichloride. By E. Polidori (*Zeit. anorg. Chem.*, 1899, **19**, 306—307).—*Titanium trichloride*, $TiCl_3 + 6H_2O$, is formed by reducing titanium tetrachloride, dissolved in 30 per cent. hydrochloric acid, by aid of the electric current; the violet solution obtained is filtered through glass wool, cooled with ice and salt, and treated with a current of dry hydrogen chloride until the salt crystallises out. The trichloride is deliquescent, oxidises very slowly in dry, but rapidly in moist air; is slowly oxidised in neutral solution with precipitation of titanium oxychloride, but is much more stable in acid solution. The solutions are energetic reducing agents, and when treated with ammonia, yield black precipitates, which, on exposure to the air, quickly turn blue and finally white. E. C. R.

Derivatives of the Tetrachlorides of Zirconium, Thorium, and Lead. By J. Merritt Matthews (*J. Amer. Chem. Soc.*, 1898, **20**, 815—839).—The tetrachlorides of zirconium, thorium, and lead do not combine with nitrosyl chloride, nitric peroxide, sulphur monochloride, phosphorus chlorides, cyanogen, hydrogen cyanide, cyanogen chloride, acetonitrile, or benzonitrile, although the chlorides of titanium and tin combine with most of these compounds (compare Hampe, *Annalen*, 1863, **126**, 43, and Baeyer, Abstr., 1875, 452). The three tetrachlorides readily combine with ammonia or amines in much the same way as do the chlorides of silicon, titanium, and tin. The compounds may be obtained by the addition of the pure anhydrous substances to the solutions of the respective chlorides; the zirconium and thorium derivatives, for the most part, form white, flocculent precipitates; the lead salts, however, are of various colours.

The following table gives a list of the compounds which have been prepared and analysed :—

	With zirconium chloride, mols. amine.	With thorium chloride, mols. amine.	With lead tetrachloride, mols. amine.
Ammonia, with dissolved chloride......	8	8	4·2
Ammonia, with solid chloride in the cold	2	6	—
Ammonia, with solid chloride when heated	4	6	—
Methylamine	4	4	4
Ethylamine	4	4	4
Propylamine...........	4	4	4
Aniline.................	4	4	3
Toluidine	4	3	decomp.
Pyridine	2	1	2
Quinoline	2	1	2
β-Naphthylamine......	2	1	1
Diphenylamine	no reaction.	no reaction.	decomp.
Acid amides............	no reaction.	no reaction.	no reaction.

Nearly all these compounds are stable in the air, the chief exceptions being the pyridine, quinoline, and the lower ammonia compounds of zirconium and thorium. None of them exhibits any sign of crystalline structure. When heated in air, they are decomposed into the hydrochloride of the amine and the dioxide of the metal, with the exception of the lead compounds which form lead dichloride. They are also decomposed by water. J. J. S.

Derivatives of the Tetrabromides of Zirconiun and Thorium. By J. Merritt Matthews (*J. Amer. Chem. Soc.*, 1898, **20**, 839—843). —The following compounds have been obtained :—$ZrBr_4 + 4NH_3$, $ThBr_4 + 3NH_3$, $ZrBr_4 + 4NH_2Et$, $ThBr_4 + 4NH_2Et$, $ZrBr_4 + 4NH_2Ph$, $ThBr_4 + 4NH_2Ph$, $ZrBr_4 + 2C_5H_5N$, $ThBr_4 + C_5H_5N$.

The bromides were prepared by Mellis' and Troost and Ouvrard's methods. Owing to the slight solubility of the tetrabromides in any of the usual organic solvents, the reagents were added to the dry salts, and any excess was removed by washing the products with ether.

Attempts to prepare lead tetrabromide were unsuccessful.

J. J. S.

Preparation of Zirconium Nitrides. By J. Merritt Matthews (*J. Amer. Chem. Soc.*, 1898, **20**, 843—846).—The compound $TiCl_4,4NH_3$, when heated in a current of ammonia, yields a nitride of titanium, Ti_3N_4 (Rose, *Ann. Phys. Chem.*, 1829, **16**, 57; Persoz, *Ann. Chim. Phys.*, 1803, **44**, 321). The authors find that when the compound $ZrCl_4 + 8NH_3$ is placed in a porcelain boat and heated to redness in a current of nitrogen, a zirconium nitride, Zr_3N_8, is obtained. This, when heated in a current of hydrogen, gives off ammonia, and leaves metallic zirconium.

A second nitride, Zr_2N_3, is obtained when zirconium tetrachloride is gradually heated to redness in a current of dry ammonia (compare Mallet, *Amer. J. Sci.*, 1858, [ii], **28**, 346).

J. J. S.

Germanium. By Clemens Winkler (*Ber.*, 1899, **32**, 307—308).—The author claims priority over Richter in the discovery of the element germanium.

T. M. L.

Vanadium Compounds of the Type VX_2. By Augusto Piccini (*Zeit. anorg. Chem.*, 1899, **19**, 204—207).—*Vanadium sulphate*, $VSO_4 + 7H_2O$, is obtained by reducing a solution of the anhydride in sulphuric acid by means of the electric current. The violet-blue solution, when allowed to evaporate in a vacuum over sulphuric acid, yields monoclinic crystals, which are decomposed on exposure to the air. The *double* salt, $VSO_4,(NH_4)_2SO_4 + 6H_2O$, obtained by electrolysing a solution of vanadium, containing ammonium sulphate, crystallises in beautiful, amethyst-blue, monoclinic crystals, and on exposure to the air is not so easily decomposed as the preceding salt. The *double* salt, $VSO_4,K_2SO_4 + 6H_2O$, resembles the ammonium salt. All three salts dissolve in water, forming yellow, or brownish-yellow, solutions, which, in the presence of acid, turn blue. Both the acid and neutral solutions absorb oxygen from the air with great rapidity.

E. C. R.

Vanadium Compounds corresponding with the Sesquioxide. By Augusto Piccini and N. Brizzi (*Zeit. anorg. Chem.*, 1899, **19**, 394—404).—Vanadium trichloride and tribromide have been described by Locke and Edwards (Abstr., 1898, ii, 598), who obtained them by dissolving the pure hydroxide in hydrochloric and hydrobromic acids respectively, but they are more easily prepared by reducing a solution of vanadic anhydride in hydrochloric or hydrobromic acid by means of the electric current. The green solution of the trichloride so obtained is cooled with ice and salt, and precipitated by saturating it with hydrogen chloride. Vanadium trichloride, in acid or neutral solution, undergoes no change when kept in a sealed tube in an atmosphere of carbonic anhydride, and the crystalline salt remains unaltered for a considerable time in air kept dry by means of lime. The trichloride corresponds in composition with chromium trichloride, and resembles the violet modification of the latter both in chemical behaviour and when examined by the cryoscopic method. Solutions of vanadium trichloride, tribromide, or tri-iodide, when treated with thallium sulphate, yield a precipitate of thallium haloid, whereby all the halogen is precipitated except the small quantity remaining in solution as thallium haloid. Vanadium tribromide is a green, hygroscopic, crystalline powder, but the aqueous solution is either brown or yellow according to the concentration, whilst the acid solution is green, but quickly becomes blue on exposure to the air. *Vanadium tri-iodide*, $VI_3 + 6H_2O$, prepared in a similar manner to the trichloride, crystallises in small, green needles, is very hygroscopic, and on exposure to the air changes into a brown liquid; in preparing this salt, it is necessary to employ a very concentrated solution saturated with hydriodic acid, and to crystallise it in a mixture of ice and salt in a desiccator over sulphuric acid.

Ammonium vanadium oxalate, $V(C_2O_4)_3(NH_4)_3 + 3H_2O$, is formed on reducing a solution of vanadic anhydride in oxalic acid by means of the electric current; to the brown solution containing a brown precipitate thus obtained, a solution of ammonium oxalate is added, the mixture warmed on the water-bath until the solution becomes clear, after which it is concentrated in a vacuum; it crystallises in green, monoclinic tablets, is stable when exposed to the air, and is soluble in water but insoluble in alcohol. The aqueous solution is green, has strong reducing properties, and is completely precipitated by ammonium and calcium chloride. The salt becomes anhydrous at 100°, but is not otherwise altered.

Potassium vanadium oxalate, $V(C_2O_4)_3K_3 + 3H_2O$, obtained in a similar manner to the ammonium salt, crystallises in green, monoclinic crystals like those of the ammonium salt, is soluble in water, but insoluble in alcohol, and is dehydrated at 100°, without decomposing. In preparing the two preceding salts, an excess of oxalic acid must be avoided, as otherwise ammonium or potassium hydrogen oxalate is precipitated.

The vanadium double oxalates are similar in composition and crystalline form to the corresponding chromium salts; they behave, however, like double salts, whereas the chromium salts behave like salts of a complex acid, and the chromium is not precipitated by ammonia, nor the oxalic acid by calcium chloride.

The authors were unable to obtain crystalline salts from a solution of vanadium sesquioxide in potassium tartrate. E. C. R.

Salts of Pyropervanadic Acid and the Constitution of the Peracid Salts. By PETR G. MELIKOFF and L. PISSARJEWSKY (*Zeit. anorg. Chem.*, 1899, **19**, 405—416).—The *ammonium* salt, $(NH_4)_4V_2O_{11}$, is obtained by dissolving ammonium metavanadate in an aqueous solution of hydrogen peroxide, adding ammonia until the solution acquires a distinct ammoniacal odour, and then precipitating the salt with alcohol. It crystallises in minute, slender, yellow, rhombic prisms, remains undecomposed for some time when dry, then slowly decomposes with evolution of oxygen. When treated with concentrated sulphuric acid, it yields ozonised oxygen, and with dilute acid, hydrogen peroxide. The ratio between the ammonia, active oxygen, and $V_2O_5 = 4NH_3 : 4O : V_2O_5$, and since the ammonium pervanadate, NH_4VO_4, is formed by the action of hydrogen peroxide on ammonium metavanadate (Scheuer, *Zeit. anorg. Chem.*, **16**, 284), it is most probable that of the four atoms of active oxygen, two are combined with V_2O_5 and two with the $4NH_3$. When the salt is treated with a solution of barium chloride, it yields an insoluble precipitate containing barium and ammonium: with silver nitrate, it yields an insoluble, yellow precipitate, which decomposes at a low temperature with evolution of oxygen.

The *potassium* salt, $3K_2O_2VO_4 + 2KVO_4 + 2H_2O$, is obtained by treating a saturated aqueous solution of potassium pervanadate with hydrogen peroxide and potassium hydroxide ($KVO_4 : 3KOH$) until a yellow solution is formed; it crystallises in yellow, rhombic prisms, is very stable, and remains undecomposed for a long time; 100 grams of water dissolve 0·855 gram of the salt at 19°. It yields oxygen when heated with water, and reacts with concentrated and dilute sulphuric acid in the same manner as the preceding salt. The constituents of the salt are in the ratio $8K_2O : 5V_2O_5 : 19O$ and it contains pyropervanadic acid and pervanadic acid. It is converted into the salt $(KO_2)_4V_2O_5 + 3\frac{1}{2}H_2O$ when treated with hydrogen peroxide and potassium hydroxide at 0°; this, which is thrown down as a dirty green, flocculent precipitate on adding alcohol to the solution, quickly decomposes with evolution of oxygen, is easily soluble in water and then decomposes with formation of the salt $3K_2O_2VO_4 + 2KVO_4 + 2H_2O$ and evolution of oxygen. When the salt $3K_2O_2VO_4,2KVO_4,2H_2O$ is treated with hydrogen peroxide and potassium hydroxide at the ordinary temperature, it yields the salt $V_2O_5(O{\cdot}OK)_3{\cdot}OK + 2H_2O$, which forms a yellow, flocculent precipitate and is intermediate in composition between the two preceding salts. The constitution of these salts and of related salts of other per-acids is discussed. E. C. R.

Preparation of Platinium free from Iridium. By Paul Bergsöe (*Zeit. anorg. Chem.*, 1899, **19**, 318—326).—See this vol., i, 320.

Action of Sulphurous Anhydride on Ruthenium Sulphate. By Ubaldo Antony and Adolfo Lucchesi (*Gazzetta*, 1898, **28**, ii, 139—142).—*Ruthenious dithionate*, RuS_2O_6, is formed when sulphurous anhydride is passed into a solution of ruthenium sulphate, $Ru(SO_4)_2$; it is very soluble in water and is precipitated from its aqueous solution by alcohol as a yellowish-white powder soluble in acids without alteration. On evaporating its aqueous solution at the ordinary temperature over a desiccating substance, ruthenious dithionate is deposited as a pale yellow mass of radiating fibres, composed of optically negative crystals, which are too small to admit of their system being determined. On warming with potassium permanganate solution, it is readily oxidised to sulphate and sulphuric acid, the oxidation being more energetic on boiling, and in this case some perruthenic acid, easily recognisable by its odour, is formed. It is also oxidised by the continued action of chlorine, bromine, nitrohydrochloric acid, hydrochloric acid and potassium chlorate, or nitric acid. The formation of ruthenious dithionate by the action of sulphurous anhydride on the sulphate comprises two distinct phases; the ruthenic sulphate being first reduced to the ruthenious compound, and sulphurous anhydride being subsequently taken up directly by the ruthenious sulphate. T. H. P.

Volatilisation of Osmium as Tetroxide in a Current of Air or Oxygen. By Ottokar Šulc (*Zeit. anorg. Chem.*, 1899, **19**, 332—334).—Powdered osmium, when heated in a current of air, becomes oxidised and volatilises below 212°; and in a current of oxygen below 170°, but no volatilisation takes place in a current of oxygen at 155°. The volatilisation in a current of air amounts to about 0·07 per cent. per hour at 212°, and to about 3 per cent. at 270°; in a current of oxygen, it amounts to about 0·02 per cent. per hour at 170° and to 1·0 per cent. at 215°. E. C. R.

Mineralogical Chemistry.

Quartz and Opal. By GIORGIO SPEZIA (*Jahrb. f. Min.*, 1899, i, Ref., 92; from *Atti Accad. Sci. Torino*, 1898, **33**, 289—308, 876—882. Compare Abstr., 1897, ii, 406).—The author finds that the solubility of quartz in water does not depend on the pressure, but only on the temperature. By the slow evaporation of the solution, the dissolved silica is deposited in the form of opal, but when alkali is present, it is deposited as quartz. The rhombohedral faces of quartz crystals are the most rapidly attacked, and on the same face there is also a greater deposition of material from a solution of silica obtained by decomposing sodium silicate. The quicker growth of quartz crystals in the direction of the vertical axis explains the common prismatic habit of this mineral.

These directions of maximum and minimum rate of growth of quartz, parallel and perpendicular respectively to the vertical axis, are confirmed by experiments (described in the second paper) on plates of certain thicknesses cut in various directions from quartz crystals.

Opal, when treated in the same manner with water and sodium silicate, is converted into an aggregate of quartz crystals.

L. J. S.

Associated Minerals of Rhodolite. By WILLIAM E. HIDDEN and JULIUS H. PRATT (*Amer. J. Sci.*, 1898, [iv], **6**, 463—468. Compare Abstr., 1898, ii, 605).—A list has already been given of the minerals identified in the concentrates of the gravels from Mason Branch, Macon Co., North Carolina.

Quartz: pseudomorphous, rhombic dodecahedra, probably after garnet. A crystal of sp. gr. = 3·203 was found to consist of a mixture of quartz and rhodolite.

Gahnite occurs as rounded octahedral crystals, and as fragments, with a clean, glassy fracture, and a deep bottle-green colour by transmitted light. Sp. gr. = 4·24—4·40. Analysis by C. Baskerville gives the formula $(12Zn,4Fe,3Mg)O,Al_2O_3$. It is, therefore, kreittonite, the zinc-iron variety of gahnite.

Al_2O_3.	FeO.	ZnO.	MgO.	Total.
61·09	7·78	27·44.	3·30.	99·61.

Bronzite of a pale yellow to deep brown colour is unusual in being perfectly transparent. Sp. gr. = 3·43.

Cordierite is abundant in boulders of granular quartz; in the interior, where only slightly altered to mica, it is pure white or yellowish and nearly transparent. Minute flakes of mica enclosed parallel to the basal plane give a golden sheen. It is wholly devoid of dichroism. An analysis by Baskerville agrees only approximately with the usual formula.

SiO_2.	Al_2O_3.	FeO.	MgO.	CaO.	H_2O.	Total.	Sp. gr.
47·60	36·20	2·13	10·73	trace	3·14	99·80	2·54

Staurolite is of a rich garnet-red and perfectly transparent; sp. gr. = 3·80.

Gold in fine scales contains 90·77 per cent. Au; sp. gr. = 17·88.

Sperrylite occurs as minute octahedral crystals of pyritohedral symmetry. L. J. S.

Analyses of Tysonite, Bastnäsite, Prosopite, Jeffersonite, Covellite, &c. By WILLIAM F. HILLEBRAND (*Amer. J. Sci.*, 1899, [iv], 7, 51—57).—*Tysonite* and *Bastnäsite*.—A crystallised specimen from Cheyenne Mountain, near Pike's Peak, Colorado, consists of tysonite (anal. I) covered on one side with a layer of bastnäsite (anal. II), there being a sharp line of demarcation between the two minerals. Under the microscope, sections show that the tysonite is penetrated by strings and grains of bastnäsite, and that all parts of the former have the same optical orientation. The tysonite contains minute enclosures and negative crystals containing fluid and cuboidal crystals. Besides the bastnäsite, there are other white and brownish alteration products of the tysonite.

	Ce_2O_3.	La group.	F.	CO_2.	CaO.	Fe_2O_3.	Na_2O.	H_2O.	Total less O for F.
I.	42·89	39·31	28·71	0·53	0·18	0·11	0·30	—	99·95
II.	37·71	36·29	7·83	20·03	—	0·22	0·18	0·08	99·04

The cerium oxide contains traces of what appears to be thoria. The metals of the lanthanum group have the at. wt. = 139·7 (anal. I) and 141 (anal. II); traces of oxides of the yttrium group may also be present. These analyses establish the formulæ $R'''F'_3$ and $R'''F'CO''_3$, which have previously only been assumed for tysonite and bastnäsite respectively.

Prosopite of a beautiful green colour occurs in the Dugway mining district, Torvel Co., Utah, associated with fluorite, silver, &c. It is not easy to separate pure material free from quartz grains; H = 4·5; sp. gr. = 2·87. Analysis gave

Al.	Ca.	Mg.	K.	Na.	Cu.	F.	H_2O.	Quartz and O.	Total.
20·08	17·55	trace	0·12	0·32	0·17	28·00	14·24	19·52	100·00

Neglecting alkalis and copper, and deducting a little calcium fluoride, this gives the prosopite formula, $CaAl_2(F,OH)_8$. Only 1·25 per cent. of water is expelled at 280°.

Jeffersonite from Franklin Furnace, New Jersey, is brown, and has a marked lamellar structure in one direction, with other cleavages; sp. gr. = 3·39. Analysis agrees with the usual formula, $R''SiO_3$.

SiO_2.	Al_2O_3.	Fe_2O_3.	MnO.	ZnO.	CaO.	MgO.	Na_2O.	K_2O.	H_2O.	Total.
51·70	0·36	0·37	7·43	3·31	23·68	12·57	0·12	trace	0·65	100·19

Titanium, ferrous oxide, and phosphoric acid are absent. Another brown substance, from Franklin Furnace, somewhat resembling jeffersonite in appearance, was found on analysis to be a mixture.

Covellite, in splendid indigo-blue masses from the East Greyrock mine at Butte, Montana, gave results agreeing closely with the formula CuS.

Cu.	S.	Fe.	Insol.	Total.	Sp. gr.
66·06	33·87	0·14	0·11	100·18	4·76

Enargite from Butte, gave

Cu.	Fe.	Zn.	As.	Sb.	S.	Insol.	Total.
48·67	0·33	0·10	17·91	1·76	31·44	0·11	100·32

Analyses are also given of mixed hydrated sulphates of copper, aluminium, &c., and of iron, aluminium, &c., from Montana.

L. J. S.

Rhodochrosite from the Odenwald. By K. von Kraatz-Koschlau (*Jahrb. f. Min.*, 1899, i, Ref. 27; from *Notizbl. Verein f. Erdkunde, Darmstadt*, 1897, [iv], **18**, 50—53).—Manganese ores are mined in the Zechstein dolomite near Bockenrod, on the north side of Morsberg. Here pale red, crystalline rhodochrosite encrusts the oxides of manganese, or cements together fragments of dolomite. Distinct crystals are rare; three habits are distinguished:—I, tabular or lenticular, with $\{111\}$ and $\{10\bar{1}\}$; II, $\{20\bar{1}\}$ with $\{111\}$ and $\{10\bar{1}\}$; III, $\{22\bar{3}\}$? with $\{111\}$. Analyses of crystals of each habit gave respectively,

	MnO.	MgO.	CaO.	CO_2.	Insol.	Total.
I.	60·89	0·84	1·23	37·00	—	99·96
	60·90	0·33	0·53	36·99	0·55	99·20
II.	—	1·31	1·14	39·03		
	—	1·12	1·29			
III.	60·87	trace	1·02	38·52	—	100·41

The succession of minerals is: (1) crystallised dolomite, (2) oxides of manganese, (3) barytes, (4) rhodochrosite, (5) barytes. The barytes is pure barium sulphate, and crystals of the two generations differ in habit.

L. J. S.

Vivianite and Chalybite in Mecklenburg Peat. By A. Gaertner (*Jahrb. f. Min.*, 1899, i, Ref. 59; from *Inaug.-Diss. Rostock, Güstrow*, 1897; and *Archiv Ver. d. Fr. d. Naturgesch. Mecklenburg*, 1898, **51**, 73—130).—The peat of the Mecklenburg moors contains considerable amounts of iron oxide and phosphoric acid; the maximum amounts, at a depth of 40—60 cm. from the surface, are: Fe_2O_3, 24·75; P_2O_5, 6·75 per cent. (organic matter, 53·41). Layers of colourless compact vivianite contain: $Fe_3(PO_4)_2$, 32·5—80·0; $FeCO_3$, 14·5—44; $CaCO_3$, 3—34, and in one case, calcium phosphate, 17 per cent. Nodules of chalybite contain: $FeCO_3$, 39—74 per cent., together with variable amounts of ferric phosphate, calcium carbonate, and iron hydroxide. Cavities in the chalybite nodules sometimes contain pale blue, crystallised vivianite.

The iron is considered to have been derived from the numerous boulders, by the action of humic acid and carbonic anhydride; and the vivianite has been formed by the action of ammonium phosphate, derived from animal remains, on the compounds of iron. L. J. S.

Formation of Glauber Salt [Mirabilite] in the Kara-bugas Gulf. By S. KUSNETZOFF (*Zeit. prakt. Geol.*, 1898, 26—27).—In the large shallow Kara-bugas gulf the loss of water consequent on the rapid evaporation is compensated by a flow through the narrow straits from the Caspian Sea. Analysis by Lebedintzeff of Caspian water gave, in 1000 parts,

NaCl.	KCl.	$MgCl_2$.	$MgSO_4$.	$CaSO_4$.	$CaCO_3$.
0·780	0·044	0·054	0·304	0·084	0·016

Here $MgSO_4:NaCl = 1:2$, whilst in water of the Black Sea the ratio is 1:11. The conditions are, therefore, favourable for the deposition of sulphates. Near the central portions of the gulf is a deposit, exceeding a foot in thickness and over a considerable area, of transparent crystals of mirabilite ($Na_2SO_4 + 10H_2O$), while nearer the shore there are deposits of gypsum on the floor of the gulf.
L. J. S.

Fibrous Goslarite from Aachen. By LOUIS GRÄFF (*Jahrb. f. Min.*, 1899, i, 76—77).—In the old workings of the Schmalgraf mine at Altenberg near Aachen, is a fibrous efflorescence with silky lustre, which is the result of the recent decomposition of blende. Analysis gives the usual formula $ZnSO_4 + 7H_2O$.

ZnO.	FeO.	SO_3.	H_2O.	Total.
27·398	0·251	27·978	44·316	99·943

L. J. S.

Thinolite. By ARTHUR M. EDWARDS (*Chem. News*, 1898, **78**, 294—295).—The author is in possession of specimens from Salt Lake desert in Utah and from Yellowstone Park which he considers to be thinolite. L. J. S.

Zoisite from the Alps. By PIERRE TERMIER (*Bull. Soc. franç. Min.*, 1898, **21**, 148—170).—A greenish-white mica-schist from Bobbio in the Cottian Alps contains, besides tremolite and albite, aggregates of small zoisite crystals not exceeding 1 mm. in length. Material of sp. gr. = 3·36 gave analytical results agreeing with the usual zoisite formula, $HCa_2(Al,Fe)_3Si_3O_{13}$, with Al : Fe = 9 : 1.

SiO_2.	Al_2O_3.	Fe_2O_3.	CaO.	MgO.	K_2O.	Na_2O.	H_2O.	Total.
39·45	30·15	4·60	23·29	0·90	0·53	0·31	0·82	100·05

The optic axial plane is approximately parallel to $c(001)$ and the acute positive bisectrix is nearly normal to $a(100)$; $\rho > v$, $2V = 35—40°$, $\alpha = \beta = 1·696$, $\gamma = 1·703$. Zoisite from Vanoise in the Savoy Alps has the same optical characters, and both are distinguished as β-zoisite.

The zoisite first examined by Des Cloizeaux differs optically from the above, and is called α-zoisite. Here the acute positive bisectrix has the same position as before, but the optic axial plane is approximately parallel to the perfect cleavage $b(010)$; also the dispersion $\rho < v$ is much greater, and sections parallel to a (100) do not completely extinguish, but are coloured violet between crossed nicols in white light. Zoisite from Ducktown in Tennessee, Clay Co. in North Carolina, Sau Alpe, and other localities consists of a regular intergrowth of these two optical varieties, both of which are identical in crystalline form, being probably anorthic with very nearly rectangular axes. L. J. S.

Composition of Tourmaline. By SAMUEL L. PENFIELD and H. W. FOOTE (*Amer. J. Sci.*, 1899, [iv], 7, 97—125).—A detailed historical review is given of the several formula which have been proposed for this complex borosilicate by Rammelsberg, Riggs, Wülfing, Scharizer, Jannasch and Kalb, Goldschmidt, Rheineck, Clarke, and Groth. So many analyses have been previously made that it was thought best to make only two accurate ones on very carefully selected material of different types. Anal. I is of clear, colourless, glassy, and perfectly pure tourmaline from De Kalb, St. Lawrence Co., New York; sp. gr. >3·033<3·065. Anal. II is of small, transparent prisms of a uniform pale green colour from Haddam Neck on the Connecticut River; sp. gr. 3·089. After fusing with sodium carbonate, the boron was distilled off with methylic alcohol and weighed as calcium borate (Gooch's method); the presence of fluorine was shown not to affect this reaction. Water and fluorine were determined directly by the methods described by Penfield in 1894. Each of the analyses (I and II) is the mean of two which are in very close agreement.

	SiO_2.	TiO_2.	B_2O_3.	Al_2O_3.	FeO.	MnO.	MgO.	CaO.	Na_2O.	K_2O.	Li_2O.	H_2O.	F.	Total (less O for F).
I.	36·72	0·05	10·81	29·68	0·22	—	14·92	3·49	1·26	0·05	—	2·98	0·93	100·72
II.	36·96	0·03	11·00	39·56	2·14	2·00	0·15	1·28	2·10	—	1·64	3·10	1·13	100·61

These do not give any simple molecular ratios; but by taking the number of hydrogen atoms equivalent to the different metals (for example, Al_2O_3 replaced by 6H) the ratios become, for I, $SiO_2 : B_2O_3 : H = 4 : 1 : 19·90$, and, for II, $= 4 : 1·02 : 19·98$. The tourmaline acid is therefore $H_{20}B_2Si_4O_{21}$. Previous analyses are discussed at length and made to agree with this formula when the necessary corrections are introduced; for example, in Rammelsberg's thirty analyses the determinations of the silica were probably too high, and of the water too low. Tourmalines containing titanium agree better with the present formula when Ti_2O_3 is assumed rather than TiO_2.

The ratio $SiO_2 : (OH,F)$ is not constant, but in all analyses the water, when directly determined, is enough for 2(OH) and in only a few cases enough for 3(OH). Further, aluminium is always present in sufficient amount to replace more than half the hydrogen atoms. All varieties of tourmaline may therefore be considered as salts of the aluminium borosilicic acid, $H_9Al_3(B{\cdot}OH)_2Si_4O_{19}$. The remaining 9H may be replaced by aluminium, alkalis, magnesium, and iron in varying proportions, and there may also be some basic hydrogen. For example, in the Haddam Neck tourmaline (anal. II), 6·1 H is replaced by Al, 1·1 H by R'', 1·2 H by R', whilst 0·6 is basic hydrogen.

When arranged according to the amount of aluminium present, tourmalines fall into the following groups:—(1) lithia tourmalines, with much aluminium and little magnesium and iron; these are generally light coloured and transparent, and difficultly fusible, and are found in pegmatite veins: (2) iron tourmalines: (3) magnesia-iron tourmalines; the last two varieties are black or dark brown owing to the presence of iron, and occur in granite, gneiss, and schist, although sometimes also in pegmatite veins: (4) magnesia tourmalines with the least amount of aluminium; these are light coloured and easily fusible, and occur in crystalline contact limestones.

These different varieties are the same in crystalline form, and are isomorphous because of the mass effect of the complex radicle, $[Al_3(B{\cdot}OH)_2Si_4O_{19}]$, which is so great that alkalis, R″ and aluminium must be considered as isomorphous constituents, just as sodium (Na_2) and calcium are isomorphous in the complex zeolites and in the sodalite-garnet group, although they are not isomorphous in more simple compounds.

Detection of Ferrous and Ferric Iron in Silicates.—The determination of ferrous iron by the ordinary method of decomposing the mineral with hydrofluoric and sulphuric acids is scarcely applicable in the case of tourmaline, as this mineral is extremely insoluble in these acids. It may be fused with borax in an inert atmosphere, decomposed with sulphuric acid, and titrated with potassium permanganate; by this method, however, a certain small proportion of the ferric iron is reduced; but the method is of easy application for the qualitative testing for ferrous and ferric iron in silicates. L. J. S.

Secondary Minerals in Andesite from Santorin. By ALFRED LACROIX (*Compt. rend.*, 1897, **125**, 1189—1191).—Cavities in hornblende-andesite from the Island of Thera, Santorin, Grecian Archipelago, are lined with crystals of tridymite, fayalite, biotite, magnetite, and hornblende. These minerals have been formed—the tridymite from the glassy base, and the others from the ferromagnesian minerals—by the action of water vapour liberated during the consolidation of the lava. Evidence of similar secondary action is seen in a tuff, the lapilli of which are coated with delicate needles of hypersthene. L. J. S.

Rocks and Minerals from Oaxaca, Mexico. By HANS LENK (*Jahrb. f. Min.*, 1899, i, Ref. 73—84; from *Beiträge zur Geol. u. Palæont. d. Republik Mexico*, 1898, **2**, 57—142).—In a petrographical paper, the following analyses are given of minerals isolated from the rocks of the State Oaxaca in Mexico. The rocks of this district are mainly Archæan penetrated by old eruptives; to the north are crystalline schists underlying sedimentaries of Cretaceous age, these being partly covered by recent volcanic rocks. *Garnet.* Analysis I, yellowish to brownish-red isotropic crystals of almandine in garnet-gneiss from Sierra de Cimaltepec. II, rose-coloured in garnet-granulite from Las Sedas between Huitzo and Nochixtlan. *Diopside.* III, pale greyish-green and transparent in pyroxene-gneiss from Sierra Ejutla. IV, pale green in graphite-granulite between Pochutla and Puerto Angel; formula, $2MgAl_2SiO_6 + 16CaFeSi_2O_6 + 29CaMgSi_2O_6$. V, greyish-green, of diallage habit, in an augite-scapolite rock north of Rancho

Zopilote, Serrania de Ejutla; formula, $4MgAl_2SiO_6 + 8CaFeSi_2O_6 + 38MgCaSi_2O_6$. VI, pale green and transparent, with $c : \mathfrak{c} = 39° 12'$, $\beta_{Na} = 1{\cdot}6820$, $2V = 58° 48'$, in a granular limestone, rich in augite and scapolite, from north of Rancho Zopilote; formula, $MgFe_2SiO_6 + 3MgAl_2SiO_6 + 22CaFeSi_2O_6 + 78CaMgSi_2O_6$.

	SiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	MnO.	CaO.	MgO.	Total.	Sp. gr.
I.	36·43	25·97	—	28·12	3·14	3·58	1·88	99·12	4·173
II.	39·24	21·89	—	24·37	0·82	7·29	6·73	100·34	3·98
III.	53·38	2·13	—	4·75	—	24·69	?	—	3·214
IV.	[52·22]	1·91	—	10·76	—	23·53	11·58	100·00	—
V.	51·89	4·18	—	4·87	—	23·38	15·31	99·63	3·108
VI.	52·46	1·31	0·68	6·78	—	23·98	14·04	99·25	3·197

Scapolite. VII, granular, probably derived from plagioclase; from the same rock as V; formula, 7*Me*5*Ma*. VIII, long prisms from the same rock as VI; $\omega = 1{\cdot}569$, $\epsilon = 1{\cdot}550$(Na); formula, 5*Me*3*Ma*.

	SiO_2.	Al_2O_3.	Fe_2O_3.	CaO.	MgO.	K_2O.	Na_2O.	Cl.	SO_3.	H_2O.	Total.	Sp. gr.
VII.	49·37	27·46	trace.	13·98	0·21	1·08	5·57	1·19	0·02	1·96	100·84	2·697
VIII.	49·09	27·95	trace.	15·71	trace.	0·33	5·02	1·50	—	1·17	100·77	2·738

Heulandite. IX, platy masses and small crystals lining crevices in amphibole-andesite from Cerro Yolomecatl. Goniometric measurements are given. $Si : Al_2 : Ca : H_2 : O = 5{\cdot}89 : 1 : 0{\cdot}77 : 5{\cdot}46 : 21{\cdot}03$. At 125°, there is a loss of 4·05 per cent. of water, at 175—200°, 8·51, and at 250—260°, of 9·37 per cent.

Sphene. X, crystals in a zoisite-augite rock from Sierra Ejutla. Optical determinations are given.

	SiO_2.	TiO_2.	Al_2O_3.	Y_2O_3.	FeO.	CaO.	SrO.	H_2O.	Total.	Sp. gr.
IX.	59·32	—	17·12	—	—	7·25	trace.	16·48	100·17	2·182
X.	28·84	41·35	2·98	trace.	1·33	25·27	—	—	99·77	3·51

Several other partial analyses of minerals and several rock analyses are given.

L. J. S.

Formation of Dolomite in the Alps. By E. Philippi (*Jahrb. f. Min.*, 1899, i, 32—46).—A review is given of the various theories which have been proposed to account for the formation of dolomite, and the following is put forward. Most limestones contain a small amount of magnesium carbonate; further, calcium carbonate is more readily soluble in water than magnesium carbonate, so that the leaching out of calcium carbonate by sea water, or by percolating rain water, would increase the relative amount of magnesium carbonate in the residue. A case supporting this theory is described from the Passo di Pallio, near Lecco, in Lombardy; a highly crystalline and friable light yellowish dolomite can here be seen to be the weathered product of a compact dark-brown dolomitic limestone. Analyses of material taken from different parts of the same hand-specimen gave: I, for the inner portion of dark compact limestone (containing, as shown by the analysis, 5·56 per cent. of dolomite); II, for the intermediate zone (87·02 per cent. of dolomite); III, the outer light-coloured crystalline portion; IV, the sand rubbed from the surface—the last two consisting of almost pure dolomite ($MgCO_3,CaCO_3$).

	CaO.	MgO.	Insoluble.
I.	54·15	1·38	0·81
II.	35·86	17·38	0·16
III.	31·38	21·04	0·28
IV.	31·33	20·90	0·16

Under the microscope, the specimens I and II show rhombohedra of dolomite set in a finely crystalline ground-mass of calcite.

L. J. S.

Meteoric Irons. By EMIL W. COHEN (*Ann. k.k. naturhist. Hofmus. Wien*, 1899, **13**, 118—158).—A summary of the literature and a detailed description of the structure of the following irons is given.

I, *Campo del Cielo*, Gran Chaco Gualamba, Argentina. This is a granular to compact ataxite composed of nickel-iron having the composition of kamacite. The etched surface appears, to the unaided eye, finely granular and homogeneous, but with a lens it shows characteristic ridges and hollows, and by deeper etching, wrinkled etch-faces. Wöhler's iron, and others, which have sometimes been considered to belong to Campo del Cielo, are quite distinct.

II, *Siratik*, Senegal, West Africa. This iron in structure and composition closely resembles the Campo del Cielo iron. It is possible that different specimens under this name may belong to different falls.

III, *Santa Rosa*, Colombia, South America. This is the mass of iron, weighing about 750 kilos., in the market-place at Santa Rosa. It is an octahedral iron of coarse structure (Zacatecas group).

IV, *Tocavita*, near Santa Rosa. Certain fragments, labelled as Santa Rosa, are found to belong to a different type; these it is proposed to distinguish as "Tocavita," after the name of the hill where they were found. The structure is octahedral, with very fine lamellæ, closely resembling that of the Ballinoo iron (Abstr., 1898, ii, 440). It is further distinguished by the presence of much rhabdite, sometimes in large crystals. A second determination of the phosphorus gave 0·52 per cent., corresponding with 3·38 per cent. of rhabdite.

V, *Rasgata*, Colombia (compare Abstr., 1897, ii, 57). This is an ataxite, and closely resembles Santa Rosa in composition.

VI, *Linnville Mountain*, Burke Co., North Carolina. This is an ataxite rich in nickel.

VII, *Chesterville*, Chester Co., South Carolina (compare Abstr., 1898, ii, 83). A granular to compact ataxite poor in nickel.

VIII, *Kokomo*, Howard Co., Indiana. In the granular structure and in the composition, this resembles the Cape of Good Hope iron.

IX, *Iquique*, Tarapaca, Peru. In structure and composition, this resembles the last.

X, *Long Creek*, Jefferson Co., Tennessee. The structure and composition of this is that of cast iron; it is, therefore, a pseudo-meteorite. Analysis X, also Mn, 0·16; SiO_2, 1·39 per cent. Analyses by O. Sjöström of these irons gave I—X respectively,

	Fe.	Ni.	Co.	Cu.	Cr.	C.	P.	S.	Cl.	Total.
I.	94·25	5·11	0·57	0·03	0·03	0·06	0·18	0·05	trace	100·28
II.	94·07	5·21	0·77	0·01	—	0·01	0·26	0·04	—	100·37
III.	92·30	6·52	0·78	0·02	trace	0·18	0·36	0·04	nil.	100·20
IV.	89·81	9·77	0·57	0·02	trace	0·03	0·22	0·06	nil.	100·48
V.	92·81	6·70	0·64	0·01	trace	0·19	0·28	0·08	trace	100·71
VI.	83·13	16·32	0·76	0·02	—	0·11	0·23	0·02	—	100·59
VII.	93·80	5·50	0·75	0·02	trace	0·02	0·34	0·03	nil.	100·46
VIII.	83·24	15·76	1·07	0·01	—	—	0·08	trace	—	100·16
IX.	83·49	15·41	0·94	0·02	trace	0·03	0·07	0·02	—	99·98
X.	94·20	nil.	nil.	—	—	4·37	0·11	—	—	100·23

These analyses correspond with the following mineralogical composition.

		Nickel-iron.	Ni-Fe phosphide.	FeS.	Sp. gr.
I.	Campo del Cielo ...	98·69	1·17	0·14	7·7679
II.	Siratik	98·21	1·68	0·11	7·7752
III.	Santa Rosa... ...	97·55	2·34	0·11	7·6896
IV.	Tocavita	98·42	1·42	0·16	7·8504
V.	Rasgata	97·97	1·81	0·22	7·6540
VI.	Linnville Mtn. ...	98·46	1·49	0·05	7·4727
VII.	Chesterville ...	97·72	2·20	0·08	7·8209
VIII.	Kokomo	99·48	0·52	—	7·8606
IX.	Iquique	99·50	0·45	0·05	7·8334

L. J. S.

Platinum and Iridium in Meteoric Iron. By John M. Davison (*Amer. J. Sci.*, 1899, [iv], **7**, 4).—The residue remaining after dissolving 608·6 grams of the Coahuila (Mexico) iron in hydrochloric acid contained 0·014 gram of metallic platinum and 0·0015 gram of a black powder insoluble in aqua regia; the latter, after fusion with zinc, was dissolved, and with ammonium chloride yielded a dark-red, crystalline precipitate, probably of ammonium iridiochloride. From 464 grams of the Toluca (Mexico) iron, a few crystals of potassium platinochloride were prepared; these were reddish in colour, no doubt due to the presence of iridium. L. J. S.

Mineral Water from Radein, Styria. By Anton Franz Reibenschuh (*Mitth. Ver. Steiermark*, 1898, **34**, 177—186).—Water from the "Neubrunnen" at Radein is perfectly clear, and has an acid taste; temperature 13·2° (that of the air being 21°); sp. gr. = 1·0061 at 21°. In 10,000 parts by weight it contains: K_2SO_4, 3·75637; Na_2SO_4, 1·04715; NaCl, 7·17978; Na_2CO_3, 35·32533; Li_2CO_3, 0·16172; $CaCO_3$, 4·13183; $MgCO_3$, 2·50100; $FeCO_3$, 0·16028; Al_2O_3, 0·10191; SiO_2, 0·18971; total solids, 54·55508; CO_2 in bicarbonates, 17·93510; CO_2 free, 23·90963; total, 96·39981. Also traces of phosphoric acid and strontium. This composition is very similar to that of the principal spring at Radein (Abstr., 1896, ii, 435). L. J. S.

Fluorine in the Waters of Néris-les-Bains. By P. Carles (*J. Pharm.*, 1898, [vi], **8**, 566—567).—The effect of these waters in making glass dull is due to the deposition of salts, chiefly calcium carbonate, and not to the action of fluorine. The fluorine is present in the waters as calcium fluoride, and not as sodium fluoride.

H. R. Le S.

Physiological Chemistry.

Temperature of the Mouth after Exercise. By Marcus S. Pembery (*Proc. Physiol. Soc.*, 1899, 21).—The mouth temperature is untrustworthy, and is not a real measure of the internal heat of the body, especially after the cooling of the mouth which is produced by exercise, or in cold weather. Buccal respiration, moreover, in man plays a part in the regulation of the temperature during exercise.

W. D. H.

Temperature of the Horse. By German Sims Woodhead (*Proc. Physiol. Soc.*, 1899, 15—18).—The figures given are numerous, and show that the temperature of the horse during rest is lower than that previously stated, and the rise of temperature on muscular exertion is more marked also. W. D. H.

Absorption of Proteids. By. P. A. Levene and I. Levin (*Proc. Amer. Physiol. Soc.*, 1898, 17. *Amer. J. Physiol.* 2).—The difficulty of studying proteid absorption is that after the intestinal wall has been passed, it is not possible to distinguish between the proteids absorbed and those already in the tissues and fluids of the body. To obviate this, iodo-proteid was used; this was placed in a loop of intestine, and then looked for in the thoracic duct; it was not found there. The result confirms the old theory, that proteids are absorbed by the blood vessels, not by the lymph, as Asher and Barbéra consider.

W. D. H.

Absorption from the Peritoneal Cavity. By Lafayette B. Mendel (*Proc. Amer. Physiol. Soc.*, 1898, 16. *Amer. J. Physiol.*, 2).—Certain coloured substances, like indigo-carmin, after they have been injected into the peritoneum, appear in the urine earlier than in the thoracic duct. This confirms Starling's statement that absorption is carried out by the blood vessels. W. D. H.

Peptic and Tryptic Digestion of Proteid. By D. Lawroff (*Zeit. physiol. Chem.*, 1899, **26**, 513—523).—After weak gastric digestion of fibrin, products are obtained which are not precipitable by ammonium sulphate, and which do not give some of the characteristic reactions of proteids. If digestion is energetic and prolonged, the products which are precipitated by ammonium sulphate, and those which are not so precipitable, fail to give the proteid reactions; even the biuret reaction in some cases is negative. The substances are crystallisable and are precipitable by alkaloidal reagents. Corresponding results are obtained on tryptic digestion. Rennin has no action on the products of peptic and tryptic digestion. Experiments with dry heat show that at 100° Danilewsky's peptone is dehydrated.

W. D. H.

Inulin in the Gastro-intestinal Tract. By RUSSELL H. CHITTENDEN and ARTHUR B. SIVITER (*Proc. Amer. Physiol. Soc.*, 1898, 18—19. *Amer. J. Physiol.*, 2).—Ptyalin, amylopsin, diastase, and taka-diastase have no action on inulin. Dilute hydrochloric acid (0·05 to 0·2 per cent.) inverts it into levulose, and hydrochloric acid combined with proteids acts in the same way, but more slowly. This inversion probably occurs in the stomach; oxalic, lactic, and salicylic acids act similarly. W. D. H.

Choline and Neurine in the Intestine during its complete Obstruction. By BEATTIE NESBITT (*Proc. Amer. Physiol. Soc.*, 1898, 8; *Amer. J. Physiol.*, 2).—Yolk of egg was given to dogs, and the intestines closed; two or three days later, when the animals were killed, choline, neurine, and a ptomaine of uncertain composition were separated from the intestinal contents. The origin of the choline and neurine was doubtless the lecithin of the food. W. D. H.

Influence of the Kidney on Metabolism. By JOHN ROSE BRADFORD (*J. Physiol.*, 1899, **23**, 415—496).—Excision of a part of one kidney in dogs is followed by some atrophy of that organ and a slight transitory wasting of the body. Approximately, two-thirds of the total kidney weight can be removed without a fatal result; there is a considerable and permanent increase of the urinary water. If three-quarters of the kidney weight be removed, death occurs in from one to six weeks; there is great wasting and weakness, but no coma or convulsions; the amount of urinary water and urea excreted is much increased. There is considerable increase also in the nitrogenous extractives in blood and tissues, particularly in the muscles. Excision of large quantities of liver substance does not give rise to the same disturbances. The experiments do not show whether or not the increase of katabolism is due to the cessation of an internal secretion normally supplied by the kidney. W. D. H.

Metabolism in Fishes. By KARL KNAUTHE (*Pflüger's Archiv*, 1898, **73**, 490—500).—The experiments made on carp show the great share the proteids take in the total metabolic exchanges, the important influence of temperature on the metabolism of proteid, and in the nutrition of the animals the importance of mineral substances for the purposes of assimilation and digestion. W. D. H.

Action of Suprarenal Extract on the Mammalian Heart. By GEORGE B. WALLACE and W. A. MOGK (*Proc. Amer. Physiol. Soc.*, 1898, 5. *Amer J. Physiol.*, 2).—Suprarenal extract stimulates the vagus centre and directly stimulates the heart muscle as well as the muscular tissue of the arterioles. W. D. H.

Action of Animal Extracts, Bacterial Cultures, and Culture Filtrates on Mammalian Heart-muscle. By ALLEN CLEGHORN (*Amer. J. Physiol.*, 1899, **2**, 273—290).—The various substances investigated were added to blood perfused through portions of the excised dog's heart. Suprarenal extract was the most powerful; it causes marked augmentation of the extent and rate of the contractions of the apex; after a time, fibrillary contractions occurred. Extract of the pituitary body, lessens the rate but increases the amplitude; extract of the infundibulum is more powerful and lessens both the rate and amplitude of the beats. Orchitic extract in small doses increases the force of the heart; larger doses decrease the tonus and increase the rhythm. Extracts of liver, pancreas, submaxillary gland, and spleen are almost inactive. Extract of kidney causes a slight fall in tonus and rate; extract of thyroid temporarily augments the force and rate, except when large doses are used; then the effect is reversed. Cultures of various bacteria affect the apex in a mechanical way; the filtrates are purely depressant, although by no means markedly so.

W. D. H.

Cholesterol of the Blood. By EBERHARD HEPNER (*Pflüger's Archiv*, 1898, **73**, 595—606).—The blood corpuscles contain cholesterol in the free condition, compounds of cholesterol with fatty acids being absent; in the corpuscles of the horse, the average percentage of cholesterol is 0·275, and in the dog, 0·552. During hunger, the quantity sinks. The blood plasma under certain circumstances (not yet clearly defined) may contain free cholesterol in addition to salts of that substance. W. D. H.

Cholesterylic Salts of Bird's Blood. By ERNEST W. BROWN (*Amer. J. Physiol.*, 1899, **2**, 306—309).—Cholesterylic oleate and palmitate were separated from the blood serum of numerous birds. Free cholesterol occurs in the corpuscles. W. D. H.

Electrical Conductivity of Animal Fluids. By WILHELM RÓTH (*Virchow's Archiv*, 1898, **154**, 466—500).—The determination of the molecular concentration of the blood-serum of ox, sheep, and pig gave a constant result; the depression of the freezing point lies between 0·55° and 0·60°. The electrical conductivity is fairly constant (96·4 to 104·6 [$\times 10^{-8}$] mercury units); this corresponds with a 0·66 to 0·71 per cent. solution of sodium chloride. Among the electrolytic molecules, sodium chloride forms a nearly constant fraction. From this is deduced a theory of the regulation of the osmotic pressures of the body-fluids. The conductivity of the whole blood is less than that of the serum, and shows considerable variations; this is due to the corpuscles.

A number of observations are also recorded on human urines, normal and pathological; the molecular concentration varies within wide limits ($\Delta = 0·8$ to 1·94 per cent.); urea does not diminish the conductivity nearly so much as proteid. In normal urine, the ratio of the total molecular concentration and the concentration of the molecules containing chlorine is nearly constant, Δ/NaCl per cent. $= 1·14$ to 1·79, but in pathological urine this is not the case, Δ/NaCl per cent. $= 1·77$ to 7·1. W. D. H.

Solution of Mercury in the Body Juices. By A. S. CHITTENDEN (*Proc. Amer. physiol. Soc.*, 1898, 6; *Amer. J. Physiol.*, **2**).—By introducing finely divided mercury into the circulation, mercury is obtained in the urine, but not in the fæces. The body juices can, therefore, dissolve metallic mercury. W. D. H,

Muscle Fatigue. By FREDERIC S. LEE (*Proc. Amer. Physiol. Soc.*, 1898, 11 ; *Amer. J. Physiol.*, 2).—The fatigue process was studied in the frog, turtle, and cat. The contraction phase is greatly lengthened in the turtle, slightly in the frog, but not at all in the cat. The relaxation is greatly lengthened in the frog and turtle, but only slightly in the cat. Diminution in lifting power is the essential factor in all cases. The sole cause of fatigue is the accumulation of fatigue-products, not decrease of contractile substance. Fatigue, in fact, is a safeguard against exhaustion. W. D. H.

Chemistry of Reticular Tissue. By M. CHRISTINE TEBB (*Proc. Physiol. Soc.*, 1899, 10—11).—The fibres of recticular tissue are anatomically continuous, and identical with the white fibres of connective tissue; Siegfried states, however, that they are different, for they yield not only gelatin, but also a new substance, reticulin. In the present investigation, reticulin was searched for both in the ordinary white fibres of tendon, and in the reticular fibres of the intestinal mucous membrane, but with negative results. Full details are promised later. W. D. H.

Conversion of the Liver Glycogen into Glucose. By DIARMID NOËL PATON (*J. physiol.*, 1899, **24**, 36—41).—The statements of previous workers that a diastatic enzyme may be prepared from the blood and tissues by means of alcohol is confirmed. The observations do not indicate that it is present in greater abundance in the liver than in other parts. The amylolytic action of the liver is frequently more powerful after treatment with alcohol. Chloroform, which accelerates the rate of amylolysis in the *post mortem* liver, does not influence, and may even retard, the amylolytic action of the alcohol liver. The opinion that hepatic amylolysis is not due to an enzyme is still adhered to. W. D. H.

Maximum Production of Hippuric Acid in Rabbits. By F. H. PARKER and GRAHAM LUSK (*Proc. Amer. Physiol. Soc.*, 1898, 14. *Amer. J. Physiol.*, 2).—If a quantity of benzoic acid (as lithium salt) is given to fasting rabbits in quantity sufficient to unite with the glycocine formed in the animal, but not sufficient to produce toxic symptoms, a fixed ratio will exist between the hippuric acid nitrogen and the total nitrogen of the urine. This ratio (1 : 20) indicates that 5 per cent. of the proteid nitrogen may be eliminated as glycocine. The ratio is not increased by feeding with carbohydrates or gelatin. W. D. H.

Iodine in the Tissues after the Administration of Potassium Iodide. By P. A. LEVENE (*Proc. Amer. Physiol. Soc.*, 1898, 15. *Amer. J. Physiol.*, 2).—The experiments recorded show that only certain keratins, such as that of the hair, only certain proteids, such as those of the thyroid, and only certain fats are capable of uniting with iodine in the organism. W. D. H.

Protamine of Mackerel Spermatozoa. By D. Kuraéeff (*Zeit. physiol. Chem.*, 1899, **26**, 524—534).—The sulphate of the protamine (*scombrine*) separated from the spermatozoa of the mackerel, has the formula $C_{30}H_{60}N_{16}O_6,2H_2SO_4$, but the chromate has the formula $C_{30}H_{58}N_{16}O_5,2H_2CrO_4$, that is, contains H_2 and O less than the sulphate. There are other differences (in solubility, optical activity) between the new protamine and others previously described. By decomposing it with sulphuric acid, less nitrogen is eliminated as arginine and histidine than is the case with clupeine and sturine.

W. D. H.

Pigments of Aplysia punctata. By Charles A. MacMunn (*J. Physiol.*, 1899, **24**, 1—10).—*Aplysiopurpurin* is a purple pigment secreted by the dermal glands of various species of *Aplysia*; it is extremely unstable, and rapidly changes into other pigments, even when kept in distilled water or in alcohol protected from the light and air. Although there is no reason to suppose that the material is a mixture of pigments, it differs somewhat in different species. It may be obtained in an approximately pure condition by a method which is described fully, but of which the chief feature is precipitation with ammonium sulphate. The integument contains whitish deposits, in which guanine was detected in small quantity. Spectroscopic plates accompany the paper. W. D. H.

Chemical Composition of the Shells of Crania, Terebratulina, and Waldheimia. By Franz Kunckell (*J. pr. Chem.*, 1899, [ii], **59**, 101—104).—These shells consist mainly of calcium carbonate; those of *Crania* contain more organic matter and more magnesium. They are also sharply distinguished from the shells of *Rhynchonella* and *Lingula*, which consist mainly of calcium phosphate, those of *Lingula* being further distinguished by the presence of a very large quantity of organic matter.

	Crania anomala, O.F.M.	*Terebratulina caput serpentis*, L.	*Waldheimia oranium*, O.F.M.
$CaCO_3$	87·8	94·6	96·2
$CaSO_4$	2·15	2·4	0·9
$Ca_3(PO_4)_2$	0·28	—	0·18
CaO	—	—	0·3
$MgCO_3$	3·4	1·05	—
MgO	1·8	—	0·6
Organic matter	4·3	2·55	2·00
	99·73	100·60	100·18

C. F. B.

Elimination of Water and of Carbonic Anhydride by the Skin. By Wakelin Barratt (*J. Physiol.*, 1899, **24**, 11—18).—When the skin is varnished, the elimination of water is reduced to 78 per cent. of the normal output; in dry inflammation, the reduction is 56 per cent. In both cases, the diminution is due to mechanical blocking of the sweat ducts. Water is, however, capable of passing through the keratin-holding epidermis. The elimination of carbonic anhydride is due to a single process, namely, that of diffusion. W. D. H.

Relation between Total Nitrogen of Urine and the Nitrogen present as Urea. By Henri Moreigne (*J. Pharm.*, 1898, [vi], **8**, 345—350, 400—405. Compare Abstr., 1899, ii, 73).—The ratio of urea nitrogen to total nitrogen in the urine of six normal subjects fed on a mixed diet varies from 86·2 (minimum) to 88·9 (maximum), with a mean of 87·5; a diet rich in meat raises this ratio from 87·7 to 90·2, an increase of 2·5 per cent. The author reviews the several causes (pathological, &c.) which may modify this ratio, and draws attention to the fact that if chloroform is added to the urine as a preservative, serious errors may arise in the determination of the urea by the hypobromite method, since chloroform vapour is evolved with the nitrogen. In estimating the nitrogen present as urea, it is not advisable to use basic lead acetate, as the nitrogenous substances are not completely precipitated by it. In subsequent experiments, in which the author employed the modified method of Mörner and Sjöquist, and the phosphotungstic acid method (this vol., ii, 72—73), he obtained for the ratio of urea nitrogen to total nitrogen a value of from 76 to 79. A formula is given for calculating the error due to the nitrogen retained by the hypobromite solution.

H. R. Le S.

Excretion of Urea and of Uric Acid. By William Bain and Wilfrid Edgecombe (*J. Physiol.*, 1899, **23**, 499—511).—The experiments made on the authors' persons lasted 77 days, the diet was carefully noted throughout and was constant, and the result of the addition of the following liquids was investigated. The saline-sulphuretted Harrogate water acted as a purgative, caused a fall in the 'worth of the blood corpuscles,' lessened the uric acid, and increased the amount of urea eliminated. Chalybeate waters caused a rise in the 'worth of the corpuscle,' or left it unaffected, and lessened the excretion of uric acid; the return to normal was more rapid than with the sulphuretted water. Tea and coffee lessened the uric acid. There is an inverse ratio between the daily excretion of uric acid, and the daily number of leucocytes.

W. D. H.

Excretion of Bases in the Urine of Fasting Rabbits. By K. Katsuyama (*Zeit. physiol. Chem.*, 1899, **26**, 543—557).—During inanition, rabbits lose in the urine much more potassium than sodium. The calcium sinks for some days, and then slowly increases until death; but the magnesium steadily sinks.

W. D. H.

Extraction of Homogentisic Acid (Quinolacetic Acid) from Urine. By Archibald E. Garrod (*J. Physiol.*, 1899, **23**, 512—514).—In two cases of alcaptonuria, the following simple method of extracting homogentisic acid was adopted. The urine is heated nearly to boiling, and 5—6 grams of normal lead acetate added per 100 c.c. of urine; the precipitate is filtered off, and the filtrate put in a cool place. At the end of 24 hours, there is complete precipitation of lead homogentisate in a crystalline form, and the acid may be obtained from this by the use of hydrogen sulphide.

W. D. H.

Cryoscopic Examination of Urine. By Ch. Bouchard (*Compt. rend.*, 1899, **128**, 64—67).—When nutrition is perfect, the large and complex molecule of albumin is broken down into simple and comparatively small molecules such as urea; when nutrition is imperfect, substances such as creatinine, uric acid, and a ptomaine, with molecular weights intermediate between those of urea and albumin, are formed, and are eliminated in the urine. It follows that the mean molecular weight of the substances dissolved in the urine will afford indications as to the character of nutrition.

Normal undiluted urine freezes at about $-1\cdot35°$, but the freezing point may vary between $-0\cdot50°$ and $-2\cdot24°$ in different pathological conditions. In order to determine the mean molecular weight of the dissolved substances, the total quantity of solid matter is estimated, the sodium chloride is estimated separately, and the freezing point is ascertained after diluting the urine with from 1 to 5 times its own volume of water to prevent separation of any dissolved matter. The quantity of sodium chloride present is subtracted from the total solids, and the reduction of freezing point attributable to the sodium chloride is subtracted from the observed reduction. The mean molecular weight P of the dissolved substances other than sodium chloride is then given by the formula $P \times 18\cdot5/C$, where C is the reduction of freezing point not due to sodium chloride.

In normal human urine, the mean molecular weight is 62 or 63, and very rarely reaches 68; it is also very rarely below 60. In illness, however, it varies from 68 to 112, except in some cases of high fever when it tends towards the normal value. It is always high in cases of tuberculosis, and high, and sometimes very high, in cases of chronic nephritis. Sometimes the high value indicates the occurrence of diseases, such as syphilis, or of sequelæ which otherwise would escape recognition. C. H. B.

Physiological Action of Choline and Neurine. By FREDERICK W. MOTT and WILLIAM D. HALLIBURTON (*Proc. physiol. Soc.*, 1899, 9—10).—It has been previously shown (Abstr., 1897, ii, 222; 1898, ii, 242) that cerebro-spinal fluid from cases of general paralysis of the insane contains choline, and that the fall of arterial blood pressure that takes place when the fluid is injected into animals is due to this substance. This base is absent from normal cerebro-spinal fluid, and is doubtless in the pathological fluid derived from the disintegration of lecithin in the cerebral tissue. The proof that the base is choline rests partly on its chemical identification in the fluid, and partly on the identical action which the fluid has with weak solutions (0·2 per cent.) of choline or choline hydrochloride. The closely related, and much more toxic, base neurine is absent.

In the case of choline, the fall of blood pressure is produced by vascular dilatation, especially in the intestinal area. Contrary to expectation, the spleen does not participate in this dilatation, but is constricted; this constriction is followed by an increase of the normal splenic waves. It seems probable that the material in extracts of brain which Schäfer and Moore (*J. Physiol.*, 20, 26) found to produce the same effect is choline. Neurine produces a much more intense constriction of the spleen, but no exaggeration of the splenic waves follows. The action of the base on the intestinal blood vessels is due to its action on the neuro-muscular mechanism of the blood vessels themselves. This was demonstrated by locally bathing the mesenteric vessels with solutions of choline; and by the fact that choline still continues to produce the usual fall of arterial pressure: (1) after the spinal cord has been divided high up; (2) after the splanchnic nerves have been cut; and (3) after the animal has been poisoned with nicotine; the last method excludes any action of peripheral ganglia.

Neurine produces a fall of blood pressure (chiefly due to its action on the heart); this is followed by a rise of pressure due to constriction of peripheral vessels. Using the same methods as in the investigation of choline, this is not an action on the central nervous system. The constriction of the vessels is, however, probably due to the action of the base on the peripheral ganglia, for after nicotine poisoning it does not occur.

The animals used have been dogs, cats, and rabbits. These were always anæsthetised with ether, chloroform, or A.C.E. mixture; in some cases, they also had a subcutaneous injection of morphine. If, however, a small amount of atropine is mixed with the morphine, the effect of choline is always a rise of blood pressure; the lever of the intestinal oncometer also rises. This fact is not without importance as showing how one poison may modify the action of another, and its bearing on general paralysis will be pointed out in the full paper which will be published shortly. W. D. H.

Physiological Action of Eucaine-B. and Analogous Substances. By Gaetano Vinci (*Virchow's Archiv*, 1898, **154**, 549—559. Compare Abstr., 1898, ii, 86).—The action of eucaine-B. was compared with that of triacetonamine, triacetonalkamine, and triacetonalkaminecarboxylic acid. The carboxyl group appears to have a highly stimulating action, and a curare-like effect on nerve endings. The introduction of an alkyl radicle into the molecule of eucaine and allied substances alters their action and increases their toxicity.

W. D. H.

Pathological Effects due to Increase of Oxygen Tension. By James Lorrain Smith (*J. Physiol.*, 1899, **24**, 19—35).—Oxygen at the tension of the atmosphere stimulates the lung cells to active absorption; at a higher tension, it acts as an irritant and produces inflammation. This conclusion, based on experiments on mice, has a direct bearing on caisson disease. The workers in caissons are occasionally under an air pressure of 4·25 atmospheres, and are undoubtedly within a very short distance of an atmosphere dangerous from the oxygen tension alone. W. D. H.

Excretion of Phosphorus and of Nitrogen in Leucæmia. By W. Hale White and F. Gowland Hopkins (*J. Physiol.*, 1899, **24**, 42—47).—Particulars of two cases of leucæmia are given. The main result is that the observations definitely negative the existence of any proportionality between the number of leucocytes and the excretion of those products (phosphoric acid and alloxuric substances) which result from the breaking down of nucleins. Much has still to be learnt concerning the general metabolism in this disease. Milroy and

Malcolm arrived at much the same conclusion; they, however, do not appear to have noted the diet of their patient. W. D. H.

Presence of Tyrosine and Leucine in Urine from a case of Cystinuria. Detection of Tyrosine. By HENRI MOREIGNE *J. Pharm.*, 1898, [vi], 8, 484—487).—The author has isolated both leucine and tyrosine from a specimen of cystinuria urine. The tyrosine was detected by the following method, which is also applicable to other urinary sediments, calculi, &c. A small portion of the urinary sediment is placed on a microscope slide and moistened with a drop of concentrated hydrochloric acid; this dissolves the cystine and other substances, but leaves the tyrosine crystals, which are easily identified by their appearance. H. R. LE S.

Chemistry of Wallerian Degeneration. By FREDERICK W. MOTT and WAKELIN BARRATT (*Proc. Physiol. Soc.*, 1899, 3—5).—Comparison of the healthy with the degenerated side of the spinal cord in two cases, shows that in the degenerated half more water is present, and there is a larger yield of ethereal extract. The ethereal extract is buttery in consistency, and contains but little phosphorus in proportion to the ethereal extract of the healthy side. The ethereal extract of the healthy side consists chiefly of crystals of protagon. These chemical results confirm those derived from histological examination; in the degeneration process, lecithin appears to be largely replaced by ordinary fat. W. D. H.

Toxicology of Phenol. By G. P. MENEGAZZI (*L'Orosi*, 1898, 21, 325—327).—0·6675 gram of phenol was injected into the rectum of a rabbit; death occurred in 37 minutes, and the animal was immediately dissected and the phenol extracted according to the method proposed by Jacobson, and recommended by Dragendorff. From the œsophagus, stomach, intestines, and their contents was obtained 0·0928 gram; from the brain, heart, lungs, liver, spleen, kidneys, muscles, and blood, 0·0878 gram; and from the urine, 0·0154 gram of phenol. The total amount of phenol extracted, 0·196 gram, forms only 29·2 per cent. of that originally injected, the deficiency being due partly to defective experimental methods, and partly to combination of the phenol with the animal tissues. N. L.

Physiological and Toxic Action of Methylxanthines and their Influence on Muscular Fatigue. By VALERIO LUSINI (*L'Orosi*, 1898, 21, 257—263).—Experiments with frogs show that the minimum toxic doses of monomethylxanthine, dimethylxanthine or theobromine, and trimethylxanthine or caffeine are 0·022—0·024, 0·014—0·015, and 0·007 gram per 100 grams of body-weight, whilst the minimum lethal doses are 0·030, 0·020, and 0·012 gram respectively. It is also found, by excitation of the sciatic nerve, and by direct excitation of the gastrocnemius muscle, that the action of these compounds in diminishing the resistance of the muscles to fatigue increases progressively from monomethylxanthine to trimethylxanthine. It therefore appears that the successive introduction of methyl groups into the xanthine molecule is accompanied by an increased toxic and physiological action. N. L.

Chemistry of Vegetable Physiology and Agriculture.

Action of Yeast on Glyceraldehyde and Dihydroxyacetone. By OTTO EMMERLING (*Ber.*, 1899, **32**, 542—544).—Although numerous investigators have stated that the mixture of glyceraldehyde and dihydroxyacetone obtained by the oxidation of glycerol, undergoes fermentation with yeast, yet this ferment is entirely without action on the pure substances. Further, on oxidising glycerol with platinum black, according to Grimaux's method, the product obtained does not evolve carbonic anhydride when treated with yeast, although after heating it for some time at 60°, a slight evolution of the gas is noticeable on adding the ferment; this is probably due to the conversion of some of the glycerose into acrose. J. F. T.

The Sorbose Bacterium. By OTTO EMMERLING (*Ber.*, 1899, **32**, 541—542: Compare Bertrand, Abstr., 1898, i, 550—556).—Bertrand has stated that the sorbose bacterium has the property of oxidising sorbitol to sorbose, and, further, of converting glycerol into dihydroxyacetone. The author finds that, not only is this correct, but that the fungus grows rapidly when placed in certain articles of food, for instance, beer, covering the surface with a thick leather-like skin, which consists of a mixture of cellulose and a compound analogous to chitin, since, on treatment with hydrochloric acid and extraction with alcohol, it gives a crystalline hydrochloride, similar in form to glucosamine (chitosamine) hydrochloride. J. F. T.

Production of Fluorescent Pigment by Bacteria. By EDWIN O. JORDAN (*Proc. Amer. Physiol. Soc.*, 1898, 18—19. *Amer. J. Physiol.*, 2).—Experiments made with six different cultures of 'fluorescent bacteria' show that phosphorus and sulphur are essential for the formation of the pigment. The following organic acidic substances are arranged in fluorescegenic value :—asparagine, succinic, lactic, citric, tartaric, uric, acetic, oxalic, and formic acids. The presence of the methyl or methylene group is thus favourable, but fluorescence is not coincident with dibasicity, or the presence of two CH_2-groups as Lepierre asserts. Diffused daylight is unfavourable to pigment production. W. D. H.

Action of Ethereal Oils on Fungi. By THOMAS BOKORNY (*Pflüger's Archiv*, 1898, **73**, 555—594).—Putrefactive bacteria and moulds were grown on nutritive media, and the amount of various ethereal oils necessary to hinder the growth was determined by adding the oil to the medium.

The terpenes are strongly toxic for moulds, less so for bacteria; their action is due to the diminution of oxidation which they cause. Cymene is a weaker poison. Whereas turpentine hinders the growth of anthrax in a concentration of 1 : 75,000, cymene in the concentration of 1 : 7500 does not hinder putrefaction. Aldehydes like vanillin are toxic also. Oil of valerian owes its poisonous character to isovaleric acid, the mustard oils to the CS:N-group.

W. D. H.

Digitalis Ferment. By BRISSEMORET and JOANNE (*J. Pharm.*, 1898, [vi], **8**, 481—484).—The statements made by Kosmann (Abstr., 1877, i, 488—489) as to the diastatic properties of digitalis ferment are based on untrustworthy experiments, but those as to its oxidising properties are confirmed. The ferment is probably a constituent of a large number of vegetable substances, and is analogous to the oxidising ferments (oxydases) isolated by Bertrand. Recently dried digitalis leaves contain the ferment, which, however, gradually disappears when the leaves are kept. H. R. LE S.

General Progress of Vegetation. By MARCELLIN P. E. BERTHELOT and GUSTAVE ANDRÉ (*Ann. Chim. Phys.*, 1896, [vii], **9**, 5—119 and 145—229).—The organic and mineral constituents were determined in seeds and in the corresponding plants at different periods of growth. The determinations were made in roots, stems, leaves, flowers, and seeds. The plants selected were white lupins, wheat, lucerne, and robinia.

Lupins.—Seeds sown April 10, 1893; plants analysed May 3 and 25, June 14, July 1, and August 24. By the 3rd of May, there was a slight loss of organic matter; the percentage of carbon in the organic matter remained the same, that of the nitrogen and hydrogen being lower by 1/10th and 1/9th respectively. There was a considerable gain of calcium and potassium, but a loss of phosphoric acid. During the next three weeks, the weight of the plant increased fourfold; the roots amounted to 11·4 per cent. of the whole plant, and contained the greatest amount of mineral matter. The production of carbonaceous was greater than that of nitrogenous substances; the percentages of carbon, hydrogen, and nitrogen were highest in the leaves. The ash constituents, especially potash, increased, more in the stems than elsewhere.

From May 25 to June 14, the increase was again fourfold, and was more in the organic than in the mineral matter, the percentage amount of which actually diminished (from 10·6 to 7·8). The amount of root became relatively less (8·8 per cent.). Ash constituents became most abundant in the leaves. There was a relative increase of carbon (especially in roots and stems).

In the next period (2 weeks), the increase in total weight was slower, and was mainly in the organic matter. The relative composition of the plant (as a whole) remained about the same.

In the last period of two months, during which fructification was completed, the absolute weight diminished by nearly a third, the loss being mainly in the organic matter, but partly in the mineral matter. The amount of root became relatively greater (11·2 per cent.); the leaves, stems, and fruit amounted respectively to 3·7, 40·7, and 44·4 per cent. of the whole plant. The roots contained the least, the leaves the most ash. The relative amounts of carbon and nitrogen were reduced, whilst the oxygen increased.

Wheat.—The results were similar to those obtained with lupins.

Lucerne.—After three months, the increase was found to be to a great extent in the roots, which amounted to nearly half the plants; the amount of stems was about the same as two months earlier, whilst the leaves diminished in weight.

Robinia.—At the time of flowering, the relation of twigs (the new shoots independently of the branches) to leaves is much less than in the case of herbaceous plants. The proportion of mineral matter is about the same as in the same parts of annual plants. At the commencement of fructification, the amount of ash in the different parts does not differ much, but subsequently there is a great accumulation of mineral matter in the leaves. N. H. J. M.

Influence of Gases and Vapours on the Growth of Plants. By Emil P. Sandsten (*Minnesota Bot. Studies,* 1898, [ii], Pt. i, 53—68).—*Oxygen.*—Seeds germinate readily in oxygen, but the seedlings do not grow so rapidly as in air. Growing shoots remain unaltered for as long as 20 days in an atmosphere containing from 25 to 100 per cent. of oxygen, but slowly die when removed.

Nitrous Oxide.—Seeds of *Phaseolus multiflorus* and *Vicia faba* failed to germinate in an atmosphere containing 80 per cent. of the gas, but the seeds were not killed, and afterwards germinated in air. Seedlings remained alive in the gas for more than 24 hours, but did not grow. Water plants (*Salvinia natans* and *Philotria*) showed increased growth in solutions saturated with nitrous oxide.

Ammonia.—Seeds of *Phaseolus* germinated in presence of gaseous ammonia (1 : 24,000) as freely as in the control experiment. Seeds of *Vicia faba,* however, failed to germinate in presence of less ammonia (1 : 28,000), but with still less ammonia (1 : 32,000), 90 per cent. of the seeds germinated. Both seeds failed to germinate when the amount of ammonia reached 1 in 20,000. The growth of young seedlings of *Zea mais* was retarded when kept for 48 hours in air containing ammonia (1 : 20,000). *Salvinia natans* and *Philotria* were killed by adding 0·1 c.c. of ammonia to 2000 c.c. of the water.

Chloroform and *Ether.*—Seedlings of *Zea mais* showed a decided acceleration in growth after being kept in moist air containing chloroform or ether (1 : 10,000); with twice the amount of either vapour, growth is greatly retarded.

Carbon Bisulphide.—The smallest trace is injurious to growing plants, but resting seeds are not affected.

Alcohol retards growth, and destroys seedlings, when present in amounts exceeding 1 in 10,000; smaller quantities have no effect on the growth of seedlings. Resting bulbs grew in an atmosphere containing one part of alcohol in 1000 to 500, but the floral organs were dwarfed and the buds remained unopened (compare Detmer, Abstr., 1883, 105). N. H. J. M.

Relation between the Intensity of the Green Colour of Leaves and the Chlorophyllic Assimilation. By Ed. Griffon (*Compt. rend.*, 1899, **128**, 253—258).—Whilst dark green leaves were generally found to possess greater assimilating energy than those of a paler green colour (cereals, lettuce, begonia, fuchsia), in some cases leaves of the same tint differed (fuchsias), or pale green leaves assimilated equally with, or even more than, leaves of a darker colour (peach, plum, chrysanthemum). The thickness and structure of the mesophyll, and the number, size, and tint of the chloroleucites in each cell are conditions which influence the colour of the leaves, either in the same or in different directions, and their action on the decomposition of carbonic anhydride gives a resultant, the nature and extent of which remains to be ascertained. In some cases, this resultant seems to be in opposition to the data furnished by anatomy. Other causes, possibly the individual activity of the chromoleucites, or the different natures of the chlorophylls, produce differences in assimilation. N. H. J. M.

Life-history of Starch Grains in Higher Plants. By ARTHUR MEYER (*Bied. Centr.*, 1899, **28**, 118—120; from *Untersuchungen über die Stärkekörner*, *Jena*, 1895; and *Bot. Centr.*, 1897, **69**, 208).—So-called starch solutions may be considered as a mixture of water and drops of a viscous solution of water in starch (amylous water-solution); iodine-starch is probably a well defined solution of iodine in starch.

The action of diastase on amylose is probably catalytic, the amylose taking up the elements of water and breaking up into two or more molecules of amylodextrin, the latter decomposing with formation of dextrin and isomaltose. Dextrin yields maltose, which is also produced by intramolecular migration from isomaltose.

Starch grains are sphæro-crystals, porous, like those of inulin and amylodextrin; they absorb about the same amount of glycerol as of water. Starch grains are never produced in the cytoplasm or in the cell sap, but grow from the beginning in a chromatophore. In chlorophyll grains, it seems to be the stroma alone which produces starch, and also diastase.

When abundant production of starch is taking place in leaves, the amount of diastase is relatively small, whilst with vigorous solution of starch the amount of diastase is high. Maltose, the last product of the decomposition of starch by diastase, can be detected in leaves.

Formation of layers is due to the unequally rapid deposition of starch. In the case of *Pellonia* and *Adoxa*, it was observed that thick, dense layers of starch were formed in the daytime, thin, loose layers in the night.

The author agrees with Berthold in considering protoplast as an emulsion essentially similar to an amylous water-solution, a more or less viscous solution of a relatively small amount of water in a substance which, in a liquefied condition, is not miscible with water.

N. H. J. M.

Assimilation of Carbohydrates and Elaboration of Organic Nitrogen by Higher Plants. By MAZÉ (*Compt. rend.*, 1899, **128**, 185—187).—Narbonne vetches were allowed to germinate in the dark, and out of contact with microbes, and when the seedlings were from 8 to 10 cm. long they were placed in solutions containing, in 1000 c.c., 1 gram of potassium phosphate, 1 gram of sodium nitrate, 2 grams of calcium carbonate, 0·2 gram of a mixture of magnesium sulphate, ferrous sulphate, and manganese chloride, and traces of zinc chloride, with from 10 grams to 60 grams of glucose. The plants were then left in the dark from 39 to 92 days. It was found that, after 92 days, the plant in the solution containing 40 grams of glucose per litre had increased in dry weight by 635·4 milligrams above the weight of the seed, whilst a plant in the solution containing 60 grams of glucose had increased by 507·2 milligrams. Plants placed under similar conditions in similar solutions containing no glucose, were found, at the end of 53 days, to weigh considerably less than the seed. The plants grown in the glucose solutions showed normal and well developed roots, whilst the total length of the stalk and its branches exceeded 1·5 metres; the leaves have a parchment-like appearance, and the folioles remain closed. Nitrates could be found in the stalks up to about the last internode. It follows that higher plants, like plants containing no chlorophyll, can live out of contact with light at the expense of compounds already elaborated. Under normal conditions, they derive their food from the much simpler compounds which result in the main from the action of bacteria and moulds on the complex organic compounds present in the soil.

C. H. B.

Influence of Carbohydrates on the Formation of Proteids in Plants. By Ernst Schulze (*Chem. Centr.*, 1898, ii, 667—668; from *Landw. Jahrb.*, 27, 516—520).—Whilst Hansteen's results (Abstr., 1898, ii, 179) with *Lemna minor*, supported Pfeffer's theory of the effect of carbohydrates on the regeneration of proteids from asparagine, the author pointed out that both in the above-ground and underground portions of plants considerable accumulations of asparagine occur along with abundance of starch or sugar; and he showed that seedlings (*Lupinus luteus*) which had accumulated asparagine during 10 days in absence of light continued to accumulate asparagine as well as proteids when exposed to light, whilst the other nitrogenous non-proteids diminished in quantity. To reconcile the author's observations with Pfeffer's theory, Borodin suggested that, not carbohydrates generally, but only glucose, is effective in the production of proteids from asparagine, an assumption which is supported by Hansteen's results with *Lemna minor*, which showed that proteids were formed from asparagine in presence of grape sugar, but not with cane sugar.

The results of recent experiments with a number of different seedlings which had been grown for two weeks or more in the dark, showed that the loss of proteids was least the greater the amount of non-nitrogenous matter present. In the changes which these substances undergo in the seedlings, soluble carbohydrates are formed from insoluble substances, a portion being converted into glucose. The glucose promotes the regeneration of proteids from asparagine, glutamine and perhaps other products of the decomposition of protein. Regeneration of protein is greatest in the case of seeds which contain the most non-nitrogenous reserve substances, but the decomposition of proteids is not checked by the presence of non-nitrogenous compounds.

N. H. J. M.

Formation of Proteids and the Assimilation of Nitrates by Phanerogams in the Absence of Light. By U. SUZUKI (*Bul. Coll. Agr. Imp. Univ. Tokyo*, 1898, **3**, 488—507. Compare *ibid.*, **2**, No. 7).—Kinoshita (Abstr., 1896, ii, 54) found that ammonium salts yield asparagine, nitrates being stored up, whilst, according to Hansteen (*Ber. deut. bot. Ges.*, 1896, **14**, 368), nitrates are but little assimilated in darkness. Ishizuka's experiments with a number of plants indicate that in darkness the nitrates stored up in the roots gradually decrease, whilst the amount of asparagine increases (*Tokyo Bul.*, 1897, **2**, 471). Godlewski concluded (Abstr., 1897, ii, 583) that nitrates are assimilated in the dark, with production of asparagine, but not of proteids; whilst Laurent (*Bul. Acad. roy. Belg.*, 1896, **32**, No. 2) maintains that neither ammonium salts nor nitrates are assimilated in absence of light.

The author's first experiments failed to show any assimilation of nitrates in the dark, but by increasing the amount of sugar from 1 to 10 per cent., very decided evidence of such assimilation was obtained. The experiments were made with barley, *Phaseolus multiflorus*, and potatoes.

In total darkness, the plants produced proteids from nitrates in presence of a sufficient amount of sugar in the plant cells; with insufficient sugar, no assimilation occurred. This accounts for some of the divergent results obtained by others.

The intermediate product, between nitrates and proteids, is most probably asparagine; this accumulates under conditions unfavourable to the production of proteids.

Zuleski's recent results also show the possibility of protein formation in darkness (*Ber. deut. bot. Ges.*, 1897, **15**, 536). N. H. J. M.

[Chlorine, Phosphorus, and Sulphur in Plants]. By MARCELLIN P. E. BERTHELOT (*Compt. rend.*, 1899, **128**, 17—23, 23—26).—See this vol., ii, 327, 330.

Occurrence of Copper in the Plant World. By GEORGE B. FRANKFORTER (*Chem. News*, 1899, **79**, 44—45).—A dead oak, at Minneapolis, was observed to have flakes of metallic copper disseminated through the pores of the wood, but particularly in the more recent annual rings. The ash from samples representing the whole tree contained 0·0012 per cent. of copper, the ash of the heart wood 0·0008 per cent., of the wood near the bark 0·00395 per cent., and of the wood midway between the bark and heart 0·00186 per cent. The powdery, cupriferous deposit itself contains 95·01 per cent. of copper, which is mostly in the metallic state, but associated with a white, crystalline substance not yet examined thoroughly. D. A. L.

Physiological Importance of Arsenic in Vegetation. By JULIUS STOKLASA (*Chem. Centr.*, 1898, ii, 43; from *Zeits. landw. Versuchsw. Oesterr.*, 1898, **1**, 155—193).—The application of superphosphate and ammonium and potassium sulphates as manures introduces much more arsenic into the soil than is generally supposed. One hundred-thousandth of the mol. wt. of arsenious anhydride (in grams per 1000 c.c. of nutritive solution) has a distinct effect on plants, whilst 1/1000 of the mol. wt. of arsenic anhydride is poisonous. Arsenic cannot replace phosphorus in vegetation.

The toxic effect of arsenious and arsenic anhydrides is manifested, especially with the phanerogams, in its disturbing effect on the activity of the chlorophyll. The destruction of living molecules is much more rapid in the chlorophyll apparatus than in the protoplasm of the plant cell.

Superphosphate contains 0·012—0·26 per cent. of arsenic; injury to plants was found to take place only when the manures contained over 0·4 per cent. of arsenic. N. H. J. M.

Oil from the Rhizome of Aspidium Filix mas. By Julius Katz (*Arch. Pharm.*, 1898, **236**, 655—662).—This oil consists of the glycerylic salts of oleic, palmitic, and cerotic acids, the chief constituent being triolein. The amount of palmitic and cerotic acids is only some 4·5 per cent.; a small amount of butyric acid is also present.

J. J. S.

Chemical and Physical Characters of some Indian Edible Oils. By Arthur W. Crossley and Henry R. le Sueur (*J. Soc. Chem. Ind.*, 1898, **17**, 989—994).—Oils from the following plants have been examined:—Liquid oils.—*Amoora rohituka, Anacardium occidentale, Arachis hypogœa, Argemone mexicana, Brassica alba, B. campestris, B. juncea, B. napus, B. nigra, Carthamus tinctorius, C. oxyacantha, Eruca sativa, Guizotica abyssinica, Juglans regia, Lepidium sativum, Linum usitatissimum, Luffa egyptica, Nigella sativa, Olea europea, Papaver somniferum, Prunus armeniaca, Raphanus sativus.* Solid oils.—*Bassia latifolia, B. butyracea, Buchanania latifolia, Cocos nucifera, Garcinia indica, Vateria indica.* In most cases, the following data are given:—Sp. gr. at 15·5°, acid value, saponification value, iodine value, Reichert-Meissel value, insoluble fatty acids, optical activity in 20 cm. tube, viscosity, and refractive index. A list is also given of the uses to which these oils are put in India. J. J. S.

Chemical Constituents of Cork. By Hermann Thoms (*Chem. Centr.*, 1898, ii, 1102—1103; from *Pharm. Centr. H.*, **39**, 699—700).—By extracting 10 kilograms of finely-divided cork with ether and evaporating, 475 grams of a rather sticky residue is obtained, from which cold ether dissolves vanillin and a waxy substance, cork-wax; the latter, when hydrolysed with alcoholic potassium hydroxide solution, yields an acid and an alcohol. From the residue of the ethereal extract which is not dissolved by cold ether, *cerin*, $C_{30}H_{50}O_2$ or $C_{32}H_{54}O_2$, is obtained by boiling it with 5 per cent. sodium carbonate solution, then with 5 per cent. potassium hydroxide solution, and drying the insoluble residue; it crystallises from ethylic acetate in lustrous needles, melts at 249°, and is soluble in the ordinary solvents. Its solution in acetic anhydride gives a pink coloration with concentrated sulphuric acid, and its solution in chloroform when shaken with an equal volume of concentrated sulphuric acid, becomes first yellow, and then, after several hours, changes to violet. Cerin belongs to the phytosterols, and yields acetyl and benzoyl derivatives.

E. W. W.

Occurrence of Tyrosine, Leucine, and Asparagine in the Pod of the Broad Bean. By EMILE BOURQUELOT and HENRI HÉRISSEY (*J. Pharm.*, 1898, [vi], **8**, 385—390).—The darkening of the pod of the broad bean at maturity is due to the presence of two oxidisable substances (*chromogens*), one of which oxidises spontaneously on exposure to the air, the other only under the influence of an oxidising ferment (oxydase). The episperm and kernel of the bean contain no oxidisable chromogen. Tyrosine, leucine, and asparagine are shown to be present in the solution obtained by the extraction of the pod with alcohol; the oxidisable chromogens are also soluble in it. The author concludes that tyrosine is the principal oxidisable chromogen. H. R. LE S.

Occurrence of Strophantin in the Algierian Oleander. By DUBIGADOUX and DURIEU (*J. Pharm.*, 1898, [vi], **8**, 433—434).—The substance obtained by mixing the dry powdered latex with chalk, lixiviating with alcohol (95°), and recrystallising the residue left on spontaneous evaporation of the solution, is shown from a comparison of its properties with those of an authenticated specimen to be identical with strophantin. H. R. LE S.

Poisonous Effect of Sodium Nitrate. By FRIEDRICH KRÜGER and G. BERJU (*Chem. Centr.*, 1898, ii, 936; from *Centr. Bakt. Par.*, **4**, ii, 674—683).—The injurious effect on plants of large amounts of sodium nitrate, and the extremely poisonous action of perchlorate observed by Sjollema (Abstr., 1897, ii, 585) and Maercker are confirmed by the authors' experiments. The peculiar bending of the plants seems, however, to be produced by an excess of pure sodium nitrate alone, as well as by perchlorate.

The poisonous symptoms and deformity produced by nitrate and perchlorate have nothing to do with the disease caused by *Rhynchosporium graminicola* Heinsen. N. H. J. M.

Analysis of Plants and Soil and the Estimation of the Quality of a Soil. By ZDZISLAW JANUSZEWSKI (*Bied. Centr.*, 1899, **28**, 77—79; from *Inaug. Diss. Leipsic*, 1895).—Field experiments on wheat were conducted at two different farms; samples of the soil being in each case submitted to mechanical separation, and the constituents soluble in 10 per cent. hydrochloric acid determined. The total nitrogen and the phosphoric acid were determined in the produce, both grain and straw. There were, in each case, five pairs of plots, (1) with manure, (2) with nitrogen alone, (3 to 5) nitrogen, together with with different amounts of phosphoric acid.

It is concluded that the analysis of the grain, but not of the straw, gives very useful indications, especially as regards phosphoric acid. But a knowledge of the composition of the best specimens of the plant obtainable is alone insufficient, as an excess of some constituent may influence the amounts of others which are taken up. When a plant contains the maximum amount of one constituent, it is to be concluded that this constituent is present [? in the soil] in sufficient quantity; but a minimum amount of any constituent in a plant may be due to various causes. Plant analysis, therefore, should only be employed for estimating the quality of a soil, in conjunction with manure experiments. N. H. J. M.

Analytical Chemistry.

Iodometry. By JULIUS WAGNER (*Zeit. anorg. Chem.*, 1899, **19**, 427—453).—The author has determined the accuracy of the estimation, by means of thiosulphate solutions, of the iodine liberated from acidified potassium iodine solutions when the oxidising agents employed are potassium and sodium bromate, potassium dichromate, potassium chromate, and potassium di-iodate. The use of a 2—3 per per cent. solution of starch is recommended as indicator, and no benefit is obtained by using more expensive preparations such as ozonised starch. The titrations must be carried out in flasks and not in beakers; a titration with potassium dichromate and potassium iodide required 25·67 c.c. of thiosulphate when carried out in a flask and three titrations varied by only 0·01 c.c.; a similar titration in a beaker required 25·52 c.c. of thiosulphate, and three titrations varied as much as 0·07 c.c.

A comparison of the results obtained by these oxidising agents shows that potassium dichromate gives results which are 0·3 per cent. higher than those obtained by any of the other salts; and this value is not altered by a further purification of the salts. This high result is due to the catalytic action of potassium dichromate effecting an oxidation of the hydrogen iodide by the air, for the difference in the titration of solutions containing air and those from which the air is expelled by a current of carbonic anhydride amounts to from 0·2 to 0·5 per cent., whereas no difference can be detected in solutions saturated with air as compared with those free from air when potassium di-iodate is the oxidising agent. The author points out that the low values obtained for the atomic weight of chromium by iodometric methods are due to this cause (Meineke, *Annalen*, 1891, **261**, 339).

Potassium dichromate may be employed for absolute determinations under known conditions; it is very easily purified by crystallisation, and should be finely powdered and dried at 100°, but it is quite unnecessary to fuse it. Potassium di-iodate gives accurate results, and is easily purified by crystallisation, either alone or with the addition of a small quantity of iodic acid to convert any iodate which may be present into di-iodate. Potassium iodate, potassium bromate, and sodium iodate give accurate results when purified by recrystallisation, or their value may be determined by a thiosulphate solution standardised by means of pure potassium di-iodate. Sodium bromate is difficult to obtain in a pure state, and, owing to its solubility, not easily purified by recrystallisation; by precipitating the aqueous solution with alcohol, a fairly uniform product is obtained, but for accurate work it must be standardised against one of the above salts. E. C. R.

Iodometric Estimation of Alkalis and Acids. By CLAUDE F. WALKER and DAVID H. N. GILLESPIE (*Zeit. anorg. Chem.*, 1899, **19**, 194—203).—Methods for the estimation of alkalis and acids based on the reactions expressed in the equations, $6ROH + 3I_2 = RIO_3 + 5RI + 3H_2O$, and $RIO_3 + 5RI + 3H_2SO_4 = 3I_2 + 3R_2SO_4 + 3H_2O$, have been previously employed by Gröger (Abstr., 1894, ii, 251) and Phelps (Abstr., 1896, ii, 673). Great care must be taken to exclude carbonic anhydride during the analysis; the alkali solution contained in a closed flask, provided with an absorption apparatus to arrest any iodine which may volatilise, is treated with a known excess of iodine solution and boiled for a short time to decompose hypoiodites, then cooled and the excess of free iodine titrated with arsenious acid. The results obtained with solutions of barium and potassium hydroxides are accurate, and are not influenced by the amount of alkali employed or by the amount of iodine in excess. A modified method of procedure is as follows: the alkali solution is allowed to flow into an excess of iodine solution contained in an Erlenmeyer flask, and the mixture boiled until all traces of free iodine are volatilised. The remaining liquid, which consists of a neutral mixture of iodate and iodide, is cooled, mixed with a slight excess of sulphuric or hydrochloric acid, and the liberated iodine titrated with thiosulphate solution. The results are very fairly accurate, although slightly lower than those obtained by Gröger's or the gravimetric methods.

The estimation of hydrochloric or sulphuric acid by this method is effected by adding the acid to a known excess of alkali, and then proceeding as above.

Alkali carbonates cannot be estimated by this method.

E. C. R.

Presence and Estimation of Chlorine in Plants. By MARCELLIN P. E. BERTHELOT (*Compt. rend.*, 1899, **128**, 23—26).—When plants are carefully incinerated, a considerable part of the carbon being left unburnt, and the residue is treated with dilute nitric acid, the quantity of chlorine obtained is too low. An accurate estimation can be made by burning the dried substance in excess of oxygen, and passing the products over red hot sodium carbonate. The differences are, however, not so great as in the case of sulphur and phosphorus. unless, during incineration, the temperature is raised to a red heat. Attempts to distinguish between total chlorine and organic chlorine, by treating the plant with dilute nitric acid and precipitating with silver nitrate, did not yield conclusive results. In all cases, the quantity of chlorine is more than sufficient to combine with all the sodium, although the difference varies in different parts of the plant, and hence it cannot be assumed that all the chlorine enters the plant in the form of sodium chloride. C. H. B.

Detection of Perchlorate in Chili Saltpetre. By NYSSENS (*Chem. Centr.*, 1898, ii, 1281; from *Bull. Assoc. Belge*, 1898).—The perchlorate is present in the Chili saltpetre as the sparingly soluble potassium salt. A weighed quantity of the Chili saltpetre is treated with 15 c.c. of a saturated solution of potassium perchlorate, and the tube containing the mixture is placed in water of the temperature of the laboratory. The saltpetre and all the soluble impurities dissolve, except the perchlorate; the insoluble matter is then collected on a filter and examined, after being washed once with the perchlorate solution and once with alcohol. If crystals of potassium perchlorate are present, the usual quantitative process should be applied.

L. DE K.

Estimation of Perchlorate in Alkali Nitrates. By N. BLATTNER and J. BRASSEUR (*Chem. Zeit.*, 1898, **22**, 589—590).—Five to ten grams of the dry and finely powdered sample, the amount of chlorine as chloride in which has been accurately determined, is carefully mixed with 8—15 grams of calcium hydroxide which is free from chlorine, and ignited for 15 minutes in a covered porcelain crucible. The addition of lime prevents the mass from melting, and, therefore, the perchlorate is reduced to chloride at a moderate temperature; the mass, moreover, can readily be transferred from the crucible to a beaker, where it is dissolved in dilute nitric acid, and the chlorine again estimated gravimetrically or by titration, after neutralising the acid by calcium carbonate; the increase corresponding with the perchlorate present. If the amount of silver chloride is very small, it may be dissolved off the filter with dilute ammonia, and evaporated to dryness in a tared dish. L. DE K.

Separation of Bromine, Chlorine, and Iodine in the form of Silver Salts. By HENRI BAUBIGNY (*Compt. rend.*, 1899, **128**, 51—54).—The separation of chlorine and bromine from iodine, when they are in the form of mixed silver salts, by the action of sulphuric acid and potassium dichromate (this vol., ii, 244), is applicable also to silver salts that have been dried at a moderately high temperature; the weight of the mixed salts, therefore, can be ascertained before they are treated further. Bromine and chlorine in the form of silver salts cannot, however, be separated satisfactorily by any method of differential oxidation. The best plan is to slightly acidify the alkaline liquid in which the chlorine and bromine have been condensed, in the process of separating them from the iodine, allow time for the sulphurous acid present to reduce any oxygen compounds of bromine and chlorine, again make alkaline, add permanganate until a permanent pink coloration is obtained, and afterwards separate the chlorine and bromine by the cupric sulphate and permanganate method (Abstr., 1898, ii, 90, 137).

In order to detect bromine in a mixture of haloid silver salts, the precipitate is mixed with a small quantity of nitric acid of sp. gr. = 1·34, and a few crystals of potassium permanganate are added. The silver iodide is converted into iodate, and the chloride is not affected, but any bromine present is liberated, and can be detected by its action on fluorescein paper (*ibid.*, 138). C. H. B.

Analysis of Organic Substances containing Sulphur and Halogens. By ANTONIO LONGI (*Gazzetta*, 1898, **28**, ii, 247—252).—The author describes the determination of sulphur and halogens in volatile organic compounds, using an apparatus which he has recently devised for estimating sulphur in illuminating gas (Abstr., 1898, ii, 535). Numerous test analyses show that the method gives good results. T. H. P.

Aræometric Valuation of Crude Sulphur. By PAUL FUCHS (*Zeit. angw. Chem.*, 1898, 1189—1190).—Fifty grams of the sulphur are dissolved in 200 grams or 158 c.c. of carbon bisulphide, and the sp. gr. of the liquid taken with a specially constructed hydrometer devised by the author; the degrees on the stem multiplied by four represent the percentage of pure sulphur in the sample.

It is necessary to first test the solvent alone, and, if needful, to make a correction. A table for temperature corrections is given; also one showing the exact relation between the sp. gr. and percentage of sulphur in solutions of the latter in carbon bisulphide. L. DE K.

Estimation of Sulphur and Alkalis in Liver of Sulphur. By LÉONCE BARTHE (*J. Pharm.*, 1898, [vi], **8**, 533—537).—The following method for the estimation of sulphur in a solution of the polysulphides of the alkalis in the absence of alkaline earths is based on the oxidising power of nascent bromine. To 1—2 c.c. of the solution are added 10 c.c. of a concentrated solution of pure soda or potash, 25 c.c. of distilled water, and 30 c.c. of a solution of sodium hypobromite. The liquid is heated to boiling, and dilute hydrochloric acid added, the heating and addition of acid being continued until all the free bromine is expelled and the liquid has become viscid. The sulphuric acid thus formed is estimated in the usual manner as barium sulphate. Since the pharmaceutical preparations of liver of sulphur are free from the alkaline earths, the estimation of the alkalis is readily effected thus: to 2 c.c. of the solution are added 20 c.c. of distilled water and 5 c.c. of concentrated sulphuric acid; the liquid is boiled, filtered through a double filter paper, the filtrate evaporated in a tared capsule, incinerated, and weighed. This gives the weight of mixed sulphates, and by dissolving these in water and precipitating with a barium salt, the total amount of sulphuric acid is determined; from the two results thus obtained, the relative amounts of sodium and potassium are readily calculated. H. R. LE S.

Estimation of Sulphuric Acid in the Presence of Iron. By GEORG LUNGE (*Zeit. anorg. Chem.*, 1899, **19**, 454—456).—A criticism of the method described by Küster and Thiel (this vol., ii, 247).

E. C. R.

Estimation of Nitric Acid. By WILHELM ACKERMANN (*Chem. Zeit.*, 1898, **22**, 690—691).—The process is based on the fact that nitrates yield their nitrogen as ammonia when boiled with ferrous sulphate and aqueous soda. To get trustworthy results, it is necessary to work under definite conditions.

The nitrate solution is made by dissolving 20 grams of the sample in water and diluting to one litre, 50 c.c. being used for the experiment; the solution is put into a 500 c.c. flask, 130 c.c. of a solution of ferrous sulphate (308 grams dissolved to 1 litre) added, and then 30 c.c. of aqueous soda of sp. gr. = 1·33; to prevent bumping, a little reduced iron is also added. The distillation is commenced at once and usually, after about half an hour's boiling, the distillate will be quite free from ammonia, but if this keeps on coming over almost to the last, the experiment cannot be trusted. The distillate is, as usual, collected in a receiver containing a known volume of standard acid, the excess of which is titrated, using litmus as indicator. The reagents must be free from ammonia and nitrates. The process may be applied to manures, if the phosphoric acid is first converted into calcium phosphate by adding a slight excess of calcium chloride, followed by the aqueous soda and the ferrous sulphate; if this precaution be not taken, the reduction of the nitrate will be very much retarded and the process will not give satisfactory results. L. DE K.

Estimation of Phosphorus and Sulphur in Plants and Plant Ashes. By MARCELLIN P. E. BERTHELOT (*Compt. rend.*, 1899, **128**, 17—23).—Experiments made with *Cynosurus cristatus* show that the quantity of phosphoric acid or sulphuric acid obtained by digesting the plant with cold dilute nitric acid, or by carefully incinerating it, is always lower than that obtained by burning the dried plant in a current of oxygen and passing the products of combustion over sodium carbonate at a low red heat. The results obtained by projecting a mixture of the substance with five times its weight of potassium nitrate into a red-hot porcelain crucible are also lower than those given by the oxygen and sodium carbonate method, although the differences are not so great as in the other cases. The general results indicate that a considerable proportion of the phosphorus and sulphur exist in the plant in the form of organic compounds and not in combination with metals. This proportion varies in different parts of the same plant.

In order to obtain accurate results, combustion of the vegetable matter must always take place in presence of an excess of oxygen, the temperature must be sufficiently high, and there must be an excess of sodium carbonate; if these conditions are not satisfied, there may be loss of both phosphorus and sulphur in one form or another

C. H. B.

Reynoso's Method for the Analysis of Phosphates. By UBALDO ANTONY and G. H. MONDOLFO (*Gazzetta*, 1898, **28**, ii, 142—147).—This method of separating the phosphate radicle from the alkaline earth metals and from iron, aluminium, &c., consists in treating the phosphate with concentrated nitric acid in presence of tin, the phosphate residue forming, with the metastannic acid, an insoluble compound, the metals from the phosphate precipitate remaining in the liquid. Some of the tin may, however, dissolve, and some of the metals may remain in the precipitate. The authors show that these disadvantages may be avoided by treating the phosphate precipitate with 77 per cent. nitric acid (sp. gr. = 1·427), and they give a modified method of testing the filtrate for iron, aluminium, &c. They have examined the insoluble compounds formed by metastannic acid with the phosphate radicle and with iron, but have arrived at no definite conclusions as to their composition. T. H. P.

Volumetric Citrate-process for the Rapid and Accurate Estimation of Phosphoric Acid in Superphosphates. By SIGISMUND LITTMAN (*Chem. Zeit.*, 1898, **22**, 691—693).—Ten grams of the superphosphate is shaken for half-an-hour with 400 c.c. of water contained in a 500 c.c. flask, which is then filled up to the mark, and the solution filtered. To 50 c.c. of the filtrate, *N*/10 soda is added until the liquid turns distinctly yellow, methyl-orange being used as indicator. The liquid now contains unaltered superphosphate and monosodium phosphate, and the former is converted into the latter by adding 10 c.c. of a solution of sodium citrate; this is prepared by carefully neutralising a solution of 30 grams of sodium hydroxide with a strong solution of citric acid, using phenolphthalein as indicator, and then diluting to 250 c.c. The mixture is now titrated with *N*/10 soda, using phenolphthalein as indicator; this operation requires practice, as the liquid is neutral just before a faint red is noticed. It is therefore advisable to again destroy the colour by *N*/10 sulphuric acid. Phosphates which contain much iron and aluminium give some trouble, but by first diluting with about 5 times the bulk of water the methyl-orange colour can be more easily observed; a second experiment is then made without dilution, using only phenolphthalein and sodium citrate, subsequently allowing for the soda required by the methyl-orange. Two mols. of sodium hydroxide represent 1 mol. of phosphoric anhydride, and the percentage in the sample is found by multiplying the number of c.c. of soda used by 0·71. Fifty test experiments are given, showing the process to be a good commercial one. L. DE K.

Estimation of Citrate-soluble Phosphoric Acid in Basic Slags. By J. FREUNDLICH (*Chem. Zeit.*, 1898, **22**, 974—975).—Wagner's latest proposal is to treat the basic slags with a 2 per cent. solution of citric acid, and precipitate with an ammoniacal solution of magnesium citrate. The author has frequently noticed that the liquid turns blackish, and that the ignited phosphate has a reddish colour; this is caused by the samples containing iron sulphide. In contact with citric acid, the latter dissolves with liberation of hydrogen sulphide, and is partially reprecipitated on neutralising the liquid. The author recommends boiling with a little nitric acid before adding the magnesium mixture. L. DE K.

Estimation of Boric Acid. By FRANK A. GOOCH and LOUIS C. JONES (*Amer. J. Sci.*, 1899, [iv], **7**, 34—40, and *Zeit. anorg. Chem.*, **19**, 417—426).—The authors have re-investigated the process devised by Gooch, which consists in distilling the borate with methylic alcohol in the presence of acetic or nitric acid, collecting the distillate in a receiver containing a known weight of calcium oxide, drying, and re-igniting; the increase in weight giving the amount of boric anhydride.

If nitric acid is used, the lime should be very gradually heated, as otherwise there will be loss by spirting, but if the quantity of nitric acid is regulated by using phenolphthalein as indicator there is no such danger. The conclusion arrived at is that the method is accurate, but this cannot be said of the process proposed by Thaddéeff (Abstr., 1897, ii, 597), in which the distillate is collected in potash solution and the boric acid estimated as potassium borofluoride; an operation attended by a serious loss of boric acid.

The calcium oxide may, however, be replaced with great advantage by sodium tungstate; this should be fused with a slight excess of tungstic acid so as to remove traces of carbonic anhydride. A weighed quantity of the compound is dissolved in water and placed in the receiver, cooled by ice and trapped with water; after half-an-hour, the liquid is transferred to the dish in which the tungstate was heated, and weighed, evaporated to dryness, and reignited. The apparatus is practically the same as that originally proposed, the retort being made from a 150 c.c. pipette and has the advantage that particles of the residue thrown up during distillation are easily removed from the side of the vessel by a rotatory motion of the retort. The test-analyses show the method to be a practical one. L. DE K.

Volumetric Estimation of Boric Acid. By LOUIS C. JONES (*Amer. J. Sci.*, 1898, **7**, 147—153).—The new process is based on the fact that boric acid does not liberate iodine from a mixture of potassium iodide and iodate.

The solution to be tested, which should be distinctly acid to litmus (any large excess of hydrochloric acid should be first neutralised with aqueous soda), is mixed with 5 c.c. of a 10 per cent. solution of barium chloride, and a very slight excess of the usual iodide-iodate mixture, containing a little starch, is added. The strong mineral acid is then neutralised, and the iodine set free is converted into neutral sodium iodide and tetrathionate by carefully bleaching the liquid with a weak solution of sodium thiosulphate.

The boric acid is now in the free state. Phenolphthalein is added, and $N/5$ solution of soda is run in until the liquid is dark red; a little mannitol is added, which bleaches the liquid, and then more soda and again more mannitol until the colour is permanent. As a rule, 1 or 2 grams of mannitol will be enough for an estimation, and the boric anhydride is then calculated by assuming that, under these conditions, 1 mol. of the acid requires 2 mols. of sodium hydroxide.

The test analyses, including an analysis of colemanite, are very satisfactory; the process is not influenced by the presence of carbonates, silicates, or fluorides. L. DE K.

Estimation of Carbonic Oxide, Methane, and Hydrogen by Combustion. By LOUIS M. DENNIS and CYRIL G. HOPKINS (*Zeit. anorg. Chem.*, 1899, **19**, 179—193).—The method consists essentially in gradually adding the oxygen or air for the combustion to the mixture of combustible gases in such a manner that the combustion is effected slowly and regularly by means of a spiral of platinum wire maintained at a red heat by the electric current. The sample of gas to be analysed is transferred to a Hempel's gas pipette, which is connected with a Hempel's burette containing the oxygen; the latter is then gradually allowed to flow into the pipette and the platinum wire in the pipette is heated to redness. When the combustion is complete, the remaining gas is transferred to the burette and measured. By this method, the production of oxides of nitrogen during the combustion is prevented. A sketch of the apparatus is given, and also the details of analysis of carbonic oxide, methane, and hydrogen, and of a mixture of the three gases. The results obtained are accurate.

E. C. R.

Estimation of Traces of Carbonic Oxide in Air. By MAURICE NICLOUX (*Ann. Chim. Phys.*, 1898, [vii], **14**, 565—574. Compare Abstr., 1898, ii, 536 and 537).—The paper contains details of an analytical method previously described. G. T. M.

Estimation of Carbon Bisulphide. By ALWIN GOLDBERG (*Zeit. angw. Chem.*, **1899**, 75—80).—When carbon bisulphide is heated with alcoholic ammonia, at 60° under pressure, one-half of its sulphur is converted into ammonium sulphide which may then be accurately titrated with zinc solution. The best results are obtained if for every gram of carbon bisulphide 5 c.c. of strong ammonia and 25 c.c. of absolute alcohol are used; aqueous ammonia may also be employed, but in that case the process requires several days. The contents of the flask, which should be yellow, are largely diluted with water, excess of standard ammoniacal zinc solution is added, and the liquid heated to boiling. The excess of zinc is then titrated with a standard solution of sodium sulphide, using sodium nitroprusside as indicator. To estimate carbon bisulphide vapour in gaseous mixtures, these are passed through Peligot tubes containing alcoholic ammonia.

A technical process for the estimation of carbon bisulphide in crude benzene is described, based on the diminution in volume by the action of alcoholic ammonia, a duplicate experiment being made with alcohol alone. Brine of sp. gr. = 1·2 is then added to both, the difference in volume representing the carbon bisulphide.

Attempts to isolate the sulphur by the action of hydroxylamine were fairly successful, but unless the amount of carbon bisulphide is already approximately known, the results are not trustworthy, as they depend on the amount of hydroxylamine added. L. DE K.

Estimation of Potassium and Sodium in the Urine. By WILMOT PARKER HERRINGHAM (*J. Physiol.*, 1899, **23**, 497—498).—One hundred c.c. of urine are evaporated to dryness with 5 grams of ammonium sulphate, and the residue treated with a few drops of sulphuric acid and heated in a platinum capsule until quite white. The ash is then dissolved in boiling water containing a little hydrochloric acid, and to the boiling liquid barium chloride is added. After filtering off the precipitated barium sulphate, the liquid is made alkaline with ammonia, and again filtered; the filtrate is treated with a slight excess of sodium hydroxide, and the excess of barium precipitated by addition of sodium carbonate. The liquid, which now contains the salts as chlorides, together with the excess of sodium hydroxide and free ammonia, is heated to remove the latter, neutralised with hydrochloric acid, and the potassium estimated as platinochloride in the usual way. The sodium is estimated by deducting from the weight of the total chlorides the weight of the potassium chloride and of the sodium chloride formed from the known amounts of sodium compounds added. W. D. H.

Volumetric Estimation of Lead Dioxide by an Alkaline Solution of Arsenious Acid. By C. REICHARD (*Chem. Zeit.*, 1898, **22**, 774—775).—Lead dioxide is reduced by boiling it with a solution of arsenious acid in sodium hydroxide; an aqueous or ammoniacal solution has no action. For a successful quantitative test, 0·1 gram of the finely-powdered sample is introduced into a flask with a little water, and after shaking the mixture, 4 c.c. of an alkaline solution of arsenic containing 0·0099 gram of arsenic trioxide per c.c. is added; the liquid is then boiled, and strong solution of soda added, until the brown dioxide has completely dissolved. The solution, diluted with water, is acidified with dilute sulphuric acid and titrated with standard permanganate. If the excess of arsenious anhydride is to be estimated by standard iodine solution, the liquid is first neutralised, then mixed with excess of sodium hydrogen carbonate, filtered hot, and when cold titrated in the usual way.

One mol. of arsenic trioxide corresponds with 2 mols. of lead dioxide.

L. DE K.

Volumetric Estimation of Cerium and its Applications. By ANDRÉ JOB (*Compt. rend.*, 1899, **128**, 101—102).—The author finds that, in the well-known reaction with hydrogen peroxide, 2 molecules of a ceric salt decompose 1 molecule of hydrogen peroxide; a ceric salt in an acid solution, therefore, can be accurately estimated by means of hydrogen peroxide. Cerous salts can be completely oxidised to ceric salts by treating them, at the ordinary temperature, with lead peroxide and an excess of concentrated nitric acid; but with dilute acid the change is not complete even on heating.

The accuracy of the results is not affected by the presence of thorium, lanthanum, and didymium, so that cerium can be readily estimated in the crude oxalates from monazite.

As acid solutions of ceric salts remained unchanged for a long time, but yet are powerful oxidising agents, they can be used where permanganate is not applicable, as, for example, in the estimation of oxalic acid in the oxalochlorides, the excess of the reagent being determined by means of hydrogen peroxide solution. The solution can be prepared from ordinary commercial cerium compounds, since the presence of the other monazite metals has no influence on the results.

C. H. B.

Estimation of Manganese by Means of Potassium Permanganate. By FREDERIC W. DAW (*Chem. News*, 1899, **79**, 25, 58, 104—105; HARRY BREARLEY, *ibid.*, **47**, 83—84).—Daw regards the presence of organic matter, the reckless use of zinc oxide in large quantities, and the standardising of the permanganate with iron instead of manganese, as sources of error in the estimation of manganese by means of permanganate, and describes a method in which these errors are eliminated. Incidentally, in the analysis of the standard ferromanganese, he ignites the trimanganic tetroxide over a blow-pipe in a platinum crucible, and in answer to remarks by Brearley on the probable effect of the permeability of heated platinum to gases on the result, he quotes some very concordant results obtained over the blow-pipe, as compared with unsatisfactory ones obtained in an underheated muffle. If iron is used to standardise the permanganate, a figure is obtained which gives low results when working on manganese, and is attributed to want of knowledge of the actual reaction that does take place, although Brearley is inclined to credit the carbon in the iron as having some influence; this, however, Daw does not admit. D. A. L.

Separation of Iron from Zirconium and Allied Metals. By J. Merritt Matthews (*J. Amer. Chem. Soc.*, 1898, **20**, 846—858).—The author gives a *résumé* of the methods which have been suggested for the separation of iron and zirconium, and then describes a method based on the solubility of ferric chloride and the insolubility of zirconium oxychloride in dry ether. The aqueous solution is evaporated to dryness on a water-bath, and when cold the residue is treated with dry ether and saturated with hydrogen chloride, in order to dissolve the iron; the solution is filtered, the residue washed with dry ether, then dissolved in water, and the zirconium precipitated as hydroxide. The ethereal solution is evaporated to dryness and the iron precipitated as hydroxide. A similar method may be adopted for separating iron from thorium, cerium, titanium, &c. The method is similar to that described by Gooch and Havens (Abstr., 1897, ii, 232) for the separation of aluminium from iron. J. J. S.

Some Characteristic Reactions of Nickel and Cobalt. By G. Papasogli (*L'Orosi*, 1898, **21**, 265—266).—If a slight excess of a solution containing 2 per cent. of sodium hydroxide and 10 per cent. of cane sugar is added to a solution of a cobalt salt, a clear blue-violet coloured liquid is obtained, whilst nickel, if present, is precipitated as the greenish-white hydroxide. In presence of much cobalt, a little of the nickel remains in solution and the liquid is opalescent. If, on the other hand, the nickel is in large excess, part of the cobalt is precipitated along with it, and the blue-violet coloration is diminished in intensity, or may not be produced at all. Nevertheless, cobalt may be detected in the solution by filtering the liquid and adding a few drops of sodium amylic dithiocarbonate solution (obtained by adding a mixture of equal volumes of amylic alcohol and carbon bisulphide to an equal volume of 50 per cent. soda), when a yellowish-green coloration is produced, which changes to maroon on adding yellow ammonium sulphide. The presence of nickel is confirmed by the blood-red coloration obtained when the precipitate remaining on the filter is dissolved in ammonia and sodium amylic dithiocarbonate is added to the solution. N. L.

Occurrence of Chromic Oxide in Algerian Phosphates. By Georg Schüler (*Zeit. angw. Chem.*, 1898, 1101—1103).—Algerian phosphates and the superphosphates made from them may be distinguished from other products by the small but distinct traces of chromium they contain. As a solution of chromic oxide in phosphoric acid is intensely green, the superphosphate made from Algerian phosphate is often distinctly green. Some samples of the raw material contained as much as 0·057 per cent. of chromic oxide.

The presence of chromium is easily proved by adding to the hydrochloric acid solution of the phosphate a large excess of ammonia; if a slight excess of acetic acid is now added to the greenish liquid, and the whole boiled, green chromic phosphate is precipitated, which may be converted into sodium chromate by adding sodium dioxide and boiling. The estimation is made in the usual way by boiling the slightly acid solution of the phosphate with sodium dioxide, and destroying the excess by continued boiling; the solution is then acidified and titrated. L. DE K.

Analysis of Molybdenum Compounds. By HARRY BREARLEY (*Chem. News*, 1899, 79, 2—4, 14—15. Compare this vol., ii, 129).—To obviate the interference of sulphuric acid in the estimation of molybdenum as lead molybdate, the mixture containing molybdic and sulphuric acids is heated to boiling, and into it is poured excess of a hot solution of lead acetate to which 30 c.c. of strong ammonium acetate has been added. Barium, if present in the molybdic solution, may be safely removed as sulphate after slightly acidifying with hydrochloric acid; but as strontium and calcium molybdates are more soluble than the barium salt, they may be disposed of by adding to the boiling molybdic solution a slight excess of hydrochloric acid, then acetic acid, lead acetate, and finally ammonium acetate, when the boiling is stopped and filtration proceeded with. This treatment is also serviceable in the presence of arsenic, cadmium, aluminium, and chromium, and in the estimation of molybdenum in alkali molybdates. Silica may be eliminated by boiling with hydrochloric acid and filtering, with or without a preliminary evaporation to dryness and ignition. The separation of iron and molybdenum presents special difficulties, precipitation as basic acetate being quite useless for the purpose, as molybdenum and iron are precipitated together; in fact, it is probable the alkali molybdates may serve for the separation of iron from other members of its group.

The separation of chromium from molybdenum by means of ammonia or soda is unsatisfactory; in the latter case, some sodium chromate is always formed, and is precipitated as lead chromate with the molybdenum, and although this factor decreases with the excess of soda used, it cannot be entirely eliminated. In the most satisfactory mode of procedure, excess of sodium hydroxide is added to the boiling hot, nearly neutral, solution of molybdenum and chromium, or, if the latter largely preponderates, the solution is added to the soda with constant shaking. After boiling for 10 minutes, the molybdenum is precipitated in a filtered aliquot part of the mixture; the lead molybdate, probably coloured yellow by chromate, is redissolved in hydrochloric acid, treated with dilute soda until the precipitate is just redissolved, and after boiling, filtering, and treating with lead acetate, the molybdenum is again precipitated; the best result is obtained with an excess of 10 c.c. of $2N$ soda. Reduction of the chromic acid is of no use for this separation. If chromic chloride is present, lead acetate is added, the cold solution slightly acidified with hydrochloric acid, and then ammonium acetate until the precipitate redissolves. On boiling, a precipitate forms, and in 10 or 15 minutes the whole of the molybdenum separates; this precipitate is ignited, boiled with hydrochloric acid, and the lead molybdate precipitated and redissolved in the manner already described; this is a most expeditious method of analysing a chrome-molybdenum.

In the presence of phosphoric acid, the formation of phosphates and phosphomolybdates causes trouble, which cannot be overcome by the use of glycerol, although lead molybdate may be accurately precipitated in the presence of that substance; but the following treatment rigorously followed overcomes the difficulty. Hydrochloric acid is added to the solution containing the molybdic and phosphoric salts in quantity sufficient to retain in solution the lead salts which are formed when enough lead acetate is added to combine with all the molybdenum and phosphorus. The heated solution is poured into, and well shaken with, a hot solution containing 10 to 15 grams of ammonium chloride, and sufficient ammonium acetate to react with the free hydrochloric acid; the whole is digested a few minutes and filtered; the filtrate should be tested for lead and the precipitate ignited. If it contains phosphorus, it is redissolved in hydrochloric acid, and the treatment with ammonium acetate and chloride repeated. To test for phosphorus, the precipitate is dissolved in hydrochloric acid, and dilute ammonia added very carefully so that any phosphomolybdate will appear before the lead molybdate; or excess of ammonia may be added at once, and the precipitate carefully redissolved in nitric acid; moreover, if only 1 or 2 per cent. of lead phosphate is present, an approximately accurate result may be obtained by completing the precipitation of the phosphomolybdate, weighing it, and allowing for it.

Estimation of Phosphorus.—It is suggested that the above method might advantageously be applied to the gravimetric estimation of the molybdenum in ammonium phosphomolybdate, and so replace the usual volumetric practice.

In the estimation of lead as molybdate, Chatard (*Chem. News*, 1871, **24**, 175) found that excess of the precipitant caused cloudiness; this may be overcome by using ammonium chloride before or with the alkali molybdate. As regards the precipitation of lead, excess of molybdate added to a lead solution containing sufficient hydrochloric acid to prevent precipitation in the cold, causes a precipitate to form on warming, whilst with excess of lead acetate the reverse is the case. When in the method of treating a mixture of hydrochloric acid, acetic acid, lead acetate, and ammonium acetate with an excess of molybdate, the lead molybdate is contaminated with molybdic acid, it may be redissolved in hydrochloric acid and reprecipitated with ammonium acetate, but without any further addition either of ammonium molybdate or lead acetate; or it may be reprecipitated with an excess of lead acetate, weighed again, the difference between the first and second weighings calculated as molybdic anhydride, and this deducted from the first weight. D. A. L.

Estimation of Tungsten. By HARRY BREARLEY (*Chem. News*, 1899, **79**, 64—66).—The precipitate formed by lead acetate in acid solutions of tungstates always consists of lead tungstate mixed with a variable quantity of tungstic acid; in alkaline solutions, and in neutral solutions (owing to the difficulty of maintaining neutrality) there is an admixture of lead oxide. Therefore the following method was devised to ensure the formation of lead tungstate without contamination. Two or three grams of ammonium nitrate and a faint excess of nitric acid are added to the alkaline tungstate, which is boiled for a few minutes, and then treated with a small excess of ammonia and an excess of lead acetate. Lead tungstate mixed with a small quantity of basic lead compound is formed, but the latter is redissolved by a few minutes brisk boiling, and the former can be ignited and weighed for the estimation of the tungsten.

A method of analysing the lead tungstate which may serve, moreover, for the separation of molybdenum and tungsten is as follows. Lead tungstate is boiled with a large excess of concentrated hydrochloric acid until the clear solution becomes opalescent, but not yellow; it is then diluted with water to the extent of four or five times the volume of the acid used, when subsequent boiling for a few minutes brings down all the tungsten as trioxide. Nitric acid also precipitates the trioxide, but it then adheres to the glass, which, in the present instance, is not the case. The trioxide is washed with very dilute hydrochloric acid, filtered, ignited, &c. The lead may be determined in the filtrate by neutralising with ammonia, acidifying with acetic acid, and precipitating with a clear solution of sodium or ammonium molybdate as described in the preceding abstract. D. A. L.

Reaction of the Arsenic-Tin Group. By J. DUCOMMUN (*Chem. Centr.*, 1898, ii, 1218—1219; from *Schweiz. Wochschr. Pharm.*, **36**, 433—434).—If a little strong formaldehyde is added to ammonium sulphide, an abundant, white precipitate is formed, which redissolves on adding a little strong sulphuric acid; very dilute ammonium sulphide gives no precipitate at all. If the liquid contains arsenious anhydride, sulphuric acid yields a white precipitate insoluble in excess; if arsenic acid is expected, the solution should be first boiled before decolorising with formaldehyde. Antimony gives a clear orange-red, tin a white, gold a yellowish-white, and platinum a brownish-red precipitate. This reaction may be utilised in qualitative analysis as follows. The acid liquid is nearly neutralised with ammonia, mixed with excess of ammonium sulphide, and boiled so as to dissolve the platinum sulphide and reduce any arsenic acid. A part of the filtrate is then largely diluted, and mixed with formaldehyde and sulphuric acid; if no precipitate is formed, the metals of the arsenic-tin group are absent. If a precipitate forms, the rest of the liquid is treated in the usual way; if not sufficiently diluted, a cloudiness will form, due to traces of copper, lead, or mercury, which are not quite so insoluble in ammonium sulphide as is generally believed.

The precipitate insoluble in ammonium sulphide may be boiled with dilute hydrochloric acid to dissolve the metals of the iron group.

L. DE K.

[Estimation of Iridium in Commercial Platinum.] By PAUL BERGSÖE (*Zeit. anorg. Chem.*, 1899, **19**, 318—326).—See this vol., i, 321.

Toxicological Detection of Acetylene. By DIOSCORIDE VITALI (*L'Orosi*, 1898, 21, 217—224).—In cases of poisoning by acetylene, the gas is to be found chiefly in the blood and lungs, and the method recommended for its detection is based on the solubility of acetylene in acetone, and on the fact that it is simply dissolved in the blood and not chemically combined with it. Some of the blood is mixed with 5—8 per cent. of its volume of acetone, the liquid distilled at 55—60°, and the usual tests applied to the distillate. If the blood has undergone putrefaction, some ferrous sulphate should be added to the liquid before distillation, in order to decompose ammonium sulphide and carbonate. The air remaining in the lungs may be examined by connecting the trachea with an aspirator and drawing the air through a washing apparatus containing a little acetone. The acetylene prepared from commercial calcium carbide is frequently contaminated with compounds of sulphur and phosphorus; these may be detected by gently warming the acetone solution with chlorine water, and subsequently applying the usual tests for sulphuric and phosphoric acids.

It is observed that acetylene has considerable antiseptic properties, since a solution of blood, saturated with acetylene, showed no signs of putrefaction after being kept for three months. N. L.

Analysis of Wine and Vinegar. By L. ERCKMANN (*Chem. Zeit.*, 1898, **22**, 673).—A number of diseased wines have been analysed. It sometimes happens that fermentation stops suddenly, and the liquid then contains from 0·2 to 2 per cent. of sugar and about 2 per cent. of volatile acids; the flavour is then like that of vinegar, but frequently there is also a disgusting taste. When evaporated to dryness, the residue from such wines frequently contains a number of needle-shaped crystals of mannitol.

The growers often attempt to render such wine saleable by neutralising the acid with lime, but as the fixed acids are neutralised before the acetic acid, the wine will contain calcium malate, which causes a crust to be formed should the wine dry on the outside of the bottle. If the greater portion of the acetic acid has also been neutralised, the extract will contain a large excess of organic calcium salts, and such a residue cannot be properly dried, even if it is moistened with water and again evaporated before placing it in the water oven.

The alcohol contained in wines or vinegars may be estimated by distillation, but the acid must first be neutralised with soda; it is, therefore, best to use the portion in which the acidity has been estimated with standard soda.

The extract of vinegar is best analysed by the process given for wine. In determining the ash of vinegar, it is advisable to cover the residue with filter paper free from ash, so as to prevent loss by the decrepitation which always occurs when heating. L. DE K.

Estimation of Pentosans. By W. L. A. WARNIER (*Rec. Trav. Chim.*, 1898, **17**, 377—383).—The author has made estimations of the amounts of furfuraldehyde obtained by distilling hexoses, dextrins, pentosans, and crude vegetable products with 12 per cent. hydrochloric acid, using the method recommended by Councler (Abstr., 1895, ii, 144). He concludes that hexoses, under the prescribed conditions, yield only very small quantities of furfuraldehyde. Two explanations of this fact are possible, namely, that the furfuraldehyde is produced by a slow carbonisation, which is, to some extent, restrained by the temperature of the liquid, or that its formation is due to the presence of a small quantity of impurity in the sugar, which is not removed by treatment with absolute alcohol; the gradual diminution of furfuraldehyde, with increased purity of the hexose, appears to support the latter view. Further, the modern method of estimating pentosans has certain faults due to difficulty of manipulation, and also to the fact that the pentosans in the products which yield the furfuraldehyde have not been obtained in a pure state. A. L.

A Colour Reaction of Wood. By ARNALDO PIUTTI (*Gazzetta*, 1898, **28**, ii, 168—170).—Orthobromophenetidine hydrochloride imparts a deep yellow colour to wood, but not to cellulose, the ordinary textile fibres, chitin, or chiratin. This reagent can, therefore, be used for determining approximately the quantity of wood-pulp added to paper, as the yellow tint is still given by wood from which all extractable matter has been removed. The hydrochlorides of other bases, such as orthobromanisidine, ortho- and para-amidophenol, paranisidine, paraphenetidine, act similarly. The coloration is probably due to an aldehydic reaction of the wood with the amido-group. T. H. P.

The Ferric Chloride Test for Phenol. By FRANZ PETERS (*Zeit. angw. Chem.*, 1898, 1078).—It is well known that the violet-blue colour which aqueous solutions of phenol give with ferric chloride is not developed in alcholic solutions. The author has made experiments in order to ascertain how much alcohol is required to render the test nugatory. He finds that a 4 per cent. aqueous solution of phenol may be mixed with 3·19 per cent. of absolute alcohol by volume (or with 2·53 per cent. by weight), without interfering with the test; the reaction is indistinct when the quantities are increased to 3·44 (or 2·73) per cent. If the solution contains more alcohol than this, a blue colour is not produced. L. DE K.

Arachidic Acid in Rape and Mustard Oils. By LEONARD ARCHBUTT (*J. Soc. Chem. Ind.*, 1898, **17**, 1009).—According to Ponzio (Abstr., 1894, i, 115), rape oil contains about 0·4 per cent. of arachidic acid, but the author finds that genuine rape-oil may contain as much as 1·43 of so-called arachidic acid (m. p. 70—72°), which is really a mixture of arachidic and lignoceric acids, although, in certain samples the amount of these acids present is practically *nil*. The same mixture of acids is met with in mustard oil; it therefore follows that the finding of arachidic acid in olive oil is not conclusive proof of the presence of earth-nut oil, unless it has been proved that rape and mustard oils are absent. J. J. S.

Estimation of Tartaric Acid. By PAUL KULISCH, P. KOHLMANN, and MAX HÖPPNER (*Zeit. angw. Chem.*, 1898, 1143—1146, and 1899, 6—9).—A criticism on the process used by German Government analysts for estimating the amount of tartaric acid in the various forms in which it occurs in wine. To perform the analysis, it is necessary to estimate the total tartaric acid, the alkalinity of the aqueous solution of the ash, and the alkalinity of the ash itself.

New formulæ are given to facilitate the calculation, and slight sources of error, such as the presence of other organic acids, are indicated. The correct estimation of the alkalinity of that portion of the ash which is soluble in water is practically impossible, as the so-called insoluble ash is not perfectly insoluble and the washings are still alkaline; it would, therefore, be advisable for analysts to agree to wash it with a definite volume of water.

In estimating the total tartaric acid by the Halenke-Möslinger process, which consists in converting the acid into potassium hydrogen tartrate by means of potassium acetate, the official instruction is to add 2 or 3 drops of a 20 per cent. solution of this salt; the authors state that in some cases this is insufficient. L. DE K.

Detection of Salicylic Acid in Wine, Beer, &c. By A. ABRAHAM (*J. Pharm.*, 1898, [vi], **8**, 410—411; from *J. Pharm. Liège*, July, 1898, 173).—For the detection of salicylic acid in beer, Jorissen's method is recommended, Rose's not being applicable. To detect the acid in wine, 200 c.c. is extracted with a mixture of ether and light petroleum, and the residue left on evaporating the ethereal extract is distilled with a mixture of 15 c.c. of distilled water and 5 c.c. of syrupy phosphoric acid; the salicylic acid is easily detected in the distillate by the usual tests (bromine water, ferric chloride, &c.). This method admits of the detection of 0·08 gram of salicylic acid per litre, even in the presence of 10 per cent. of tannin.

H. R. LE S.

Distinctive Reactions of Tannin and Gallic Acid. By GIUSTINIANO TODESCHINI (*L'Orosi*, 1898, **21**, 328—330).—According to David, when potash and barium chloride solution are added to a solution of tannin, a red precipitate is produced, the colour of which gradually increases in intensity, whilst with gallic acid, under similar conditions, a blue precipitate is obtained. The author confirms the reaction in the case of gallic acid, but finds that the results obtained with tannin vary with the dilution. Thus, with a 1 per cent. solution of tannin a green precipitate, changing to greenish-blue, is formed, whilst with a 0·1 per cent. solution, and especially in the presence of much potash, a somewhat reddish-yellow precipitate is obtained, which at first increases and then diminishes in intensity. Potash alone gives with tannin and with gallic acid a greenish coloration, becoming of an intense red on agitation with air, and it seems probable that the red colour observed by David with tannin is due to this reaction, which is more apparent with tannin than with gallic acid, since the precipitate given by the former with potash and barium chloride is less abundant and not so intensely coloured.

A list of the reactions of gallic acid and tannin is given. N. L.

Analytical Notes [Tannin: Iron in Water: Zinc Iodide Starch Solution]. By ANTON SEYDA (*Chem. Zeit.*, 1898, **22**, 1085—1086).—*A Delicate Test for Tannin.*—The author has noticed that if gold chloride is added to a very dilute solution of tannin, a clear, purple coloured liquid is obtained; this test is so sensitive that it gives a reddish colour with claret which has been so largely diluted with water as to be practically colourless. In extremely dilute solutions, it will take about half an hour before the colour is fully developed, and this is perhaps the reason that the extreme delicacy of the reaction has not been previously noticed. Its principal use is to detect tannin in highly coloured extracts; the test may also be useful in microscopy.

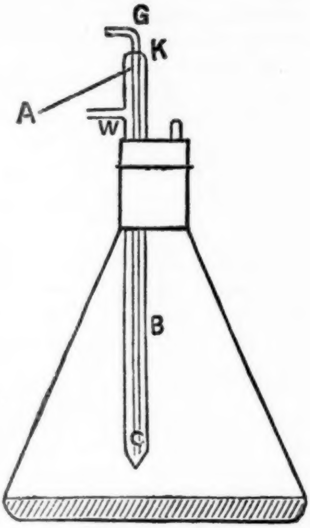
Colorimetric Estimation of Iron in Water.—The process recommended is practically the same as that devised by Lunge (Abstr., 1896, ii, 392). The author, however, recommends the destruction of any organic matter by evaporating the water to dryness and igniting the residue, which is then fused with a little sodium hydroxide to render the iron more soluble.

Preparation of Zinc Iodide-Starch Solution. Two to three grams of potato starch is mixed in a mortar with 50—100 c.c. of water, and after an hour the emulsion is heated in a pressure flask in an oil bath at 130° for 2 to 4 hours; when cold, the liquid is rinsed into a litre flask with about 750 c.c. of hot water, and after 24 hours filtered through a quick filter. A solution of 20 grams of zinc chloride and 2 grams of zinc iodide is then added, and should a bluish colour be noticed this is removed by means of a very dilute solution of sodium thiosulphate. The mixture, diluted to one litre, is left for 24 hours before being filtered. This solution will keep indefinitely if a bottle of brown glass be used. L. DE K.

Reactions of Bile Acids and their Detection in Urine. By DIOSCORIDE VITALI (*L'Orosi*, 1898, **21**, 397—407).—Two new reactions of glycocholic and taurocholic acids are described. If about 0·5 c.c. of concentrated sulphuric acid is added to a fragment of the bile acids, or to the cooled residue obtained by evaporating their solution to dryness, a yellow coloration is produced which, on warming, becomes orange-red and then blood-red. On still further heating and adding more sulphuric acid, the liquid acquires a beautiful green fluorescence which is destroyed on adding water; this reaction, which is also given by cholic acid and by cholesterol, is obtained with 0·00001 gram of bile acids. In the presence of other organic substances giving a brown colour with sulphuric acid, the yellow and red colorations described may be obscured, but the green fluorescence may still be obtained if a large volume of sulphuric acid is employed. In the second reaction, after adding sulphuric acid as before, a few drops of weak chlorine water are cautiously added, when green striæ, changing to blue, violet, and red, are seen at the junction of the two liquids, and on adding more sulphuric acid, the green fluorescence is produced.

As neither of the above reactions can be directly applied to urine, the bile acids must be first extracted, either by Hoppe-Seyler's process or by one of four methods, described in detail in the paper, based on the dissolution of the acids in amylic alcohol or in a mixture of alcohol and chloroform, or on their precipitation as the quinine salts or in combination with albumin. If bile pigments are present, they must be removed by treatment with freshly prepared lead sulphide according to the method previously described by the author. N. L.

Apparatus for the Saponification of Fats, &c. By J. G. Annan (*Chem. News*, 1899, 79, 51).—The weighed fat and alcoholic potash are charged into an Erlenmeyer flask and a doubly bored cork is inserted, in one hole of which the condensing arrangement shown in the cut is fixed and connected at W with a water supply; the flask is gently heated until the air is displaced, when a glass plug is put in the other hole. A current of cold water is now caused to circulate in the tube B, entering at W, and escaping at G, and the liquid in the flask may be boiled vigorously without any further attention until saponification is complete. The tube B is 5 inches long, and 3/8-inch bore, the tube C 1/8-inch bore. D. A. L.



Detection of Phytosterol and Cholesterol in Fats. By Hans Kreis and Otto Wolf (*Chem. Zeit.*, 1898, ii, 805—806).—Fifty grams of the sample is saponified by boiling with 125 c.c. of 95 per cent. alcohol and 25 c.c. of 40 per cent. aqueous soda; when the fat has dissolved, the solution is evaporated in a spacious porcelain dish until the bulk of the alcohol has been driven off. The soap is then dissolved in 500 c.c. of boiling water, transferred to a 2-litre flask, nearly neutralised with hydrochloric acid, using phenolphthalein as indicator, and 100 c.c. of a 10 per cent. solution of calcium chloride is added at once, shaking the mixture well to facilitate separation of the lime-soap. The precipitate, which is collected on a cloth and pressed dry, finally between blotting paper, contains all the cholesterol or phytosterol. The powdered lime-soap is boiled for an hour with 100 c.c. of alcohol, filtered when cold, and the filtrate mixed with 3 c.c. of aqueous soda and evaporated to dryness to saponify any fat which may have escaped decomposition. The residue is powdered and extracted in a closed flask with 50 c.c. of ether for an hour, shaking frequently, the ether evaporated, and the residue recrystallised from a very small quantity of boiling alcohol; the phytosterol or cholesterol is then obtained in a pure and white condition.

The authors have successfully applied this process to butter, lard, and cotton-seed oil. Quantitative experiments will be reserved for a future paper. L. de K.

Toxicological Processes for Detecting Alkaloids. By Anton Seyda (*Chem. Centr.*, 1898, 2, 1288—1289; from *Zeit. öffentl. Chem.*, 4, 699—705; 721—747; 762—769).—It is needful to examine the contents and membranes of the bladder, as these often contain the poison when the other organs do not. The investigation is rendered more troublesome when medicines have been administered, such as preparations of colombo, rhatany, mercury, &c. If the organs are in an advanced state of decomposition, ptomaines are formed which interfere with the tests for opium alkaloids and strychnine. Meconic acid and meconine cannot be always detected, as these are decomposed both during life and after death.

In bodies which are likely to contain ptomaines, the opium or *Strychnos* alkaloids are best searched for by the gypsum method recommended by Hilger and Küster; Kippenberger's iodine process for the purification of the crude alkaloids extracted by chloroform was also found to be very satisfactory. It is desirable that new solvents for the extraction of the alkaloids should be tried.

L. DE K.

Piutti's Reagent for Alkaloids (Iodised Parethoxyphenylsuccinimide). By GUIDO SIMONCELLI (*Gazzetta*, 1898, **28**, ii, 171—177).—By comparative titrations of quinine hydrogen sulphate with an acetic acid solution of Piutti's reagent and one of equivalent strength of iodine and potassium iodide, the author finds that the same volume of either solution will completely precipitate the alkaloid, and that in the case of the former the parethoxyphenylsuccinimide is not precipitated, but remains undecomposed in solution in the acetic acid; the precipitates obtained in the two cases are identical.

Using solutions of quinine and brucine, the relative sensitiveness to these alkaloids of Piutti's reagent, of an equivalent solution of iodine in potassium iodide, of Bouchardat's and of Selmi's reagents was determined; the results show that there is little difference between Piutti's reagent and the iodine solution, and that both these are more sensitive than Bouchardat's or Selmi's reagent. T. H. P.

Piutti's Reagent for Alkaloids. By NINO SCARPITTI (*Gazzetta*, 1898, **28**, ii, 177—189. See preceding abstract).—The author has extended the experiments made by Simoncelli to the following alkaloids:—Atropine, quinidine, cinchonidine, cinchonine, cocaine, codeine, coniine, daturine, hydrastine, morphine, narcotine, nicotine, papaverine, sparteine, strychnine, and veratrine. His results show that Piutti's reagent is much more sensitive than either Bouchardat's or Selmi's, or than a solution of iodine in potassim iodide. Voluminous tables accompany the paper. T. H. P.

Detection of Quinine in Urine by Means of Picric Acid. By ANASTASIOS CHRISTOMANOS (*Chem. Centr.*, 1898, ii, 1284—1285; from *Berl. klin. Wochschr.*, **35**, 976).—Quinine may be detected in urine by the dense, yellowish-white precipitate given by picric acid, which is quite distinct in appearance from that due to uric acid or creatinine. No precipitate is yielded in the urine after partaking of caffeine, antipyrine, phenacetin, salol, or sodium salicylate, but albumin, unless there is only a mere trace, interferes with the test, as it is also precipitated by picric acid. On attempting to remove the albumin by boiling, the quinine is also precipitated. L. DE K.

General and Physical Chemistry.

Changes of Rotation of Active Electrolytes in Dilute Solutions. By EBERHARD RIMBACH (*Zeit. physikal. Chem.*, 1899, **28**, 251—256).—The absolute values for the dissociation of rubidium tartrate obtained from the rotation do not agree with the conductivity determinations, although the relative values are in fair accord, and it is considered probable that the value for infinite dilution obtained by extrapolation was inaccurate (Abstr., 1895, ii, 301). In order to further test the influence of dilution and dissociation on rotation, the latter constant was determined up to very high dilutions for the slightly dissociated mandelic acid and the more highly dissociated sodium salt, and the values compared with those obtained from the linear formula of Lewkowitsch. In the case of the sodium salt, the values agree, even with a concentration of somewhat below 1 per cent., but differ to the extent of 3 per cent. in a 0·05 per cent. solution, whilst, for the acid itself, the difference between the found and calculated values becomes apparent at a concentration of 3 per cent., and rapidly increases with further dilution, so that extrapolation for the value at infinite dilution can only be applied with strong electrolytes.

L. M. J.

Dissociation Spectra of Fused Sulphates, Sulphides, Phosphates, and Salts containing both Sulphur and Phosphorus. By ARNAUD DE GRAMONT (*Bull. Soc. Chim.*, 1898, [iii], **19**, 54—57, 57—58, and 58—59).—The spark spectra of alkali sulphates and sulphides exhibit the chief lines of Salet's spark spectrum of sulphur; the following groups of lines can also be observed: $S\phi$, $\lambda = 6416{\cdot}5$, $6402{\cdot}5$, 6390, and $S\psi$, $\lambda = 6320{\cdot}0$, $6309{\cdot}5$, and 6291. The spark spectra of fused alkali phosphates and of metals containing phosphorus exhibit the principal lines of the non-metal; the presence of phosphorus in samples of cast iron can be readily detected by the lines 6043, 6035, and 6026 of the well-defined triplet $P\alpha$, although these become invisible when less than 0·1 per cent. is present. The spectra of thiophosphates (Friedel, Abstr., 1895, ii, 13) exhibit the principal lines of both sulphur and phosphorus, those of the latter being very strongly defined; the lines of sulphur only become visible when the condenser employed has a surface area greater than 25 square decimetres. Detailed measurements are given in the papers; it appears that the spark spectrum affords a delicate method of detecting the elements dealt with, in solid compounds, even when these are almost non-conducting. W. A. D.

Osmotic Theory of the Galvanic Cell. By WALTHER NERNST and EMIL BOSE (*Zeit. Elektrochem.*, 1898, **5**, 233—235).—According to the osmotic theory of the galvanic cell, the potential difference between a metal and a solution is $E = RT/n \log C/c$. The electrolytic solution tension of the metal, C, and the number of electric charges with which it passes into the ionic state, n, depend on the nature of the metal alone. By changing the concentration, *c*, of the metallic ions in the solution in any way, the potential difference, *E*, must also be changed. To test this, a mercury electrode covered with mercurous sulphate and a slowly-dropping mercury electrode, are placed in glass tubes containing normal sulphuric acid, and connected by a long, narrow, horizontal tube. The tube containing the dropping electrode contains, in addition, two platinum electrodes, by means of which any traces of metal may be removed from the solution in contact with the dropping mercury by electrolysis. The potential difference between the two mercury electrodes must be measured by an electrometer, the dropping electrode being polarised excessively readily. The highest potential difference observed was 0·443 volt. With silver electrodes in 0·01 normal hydrochloric acid, the acid surrounding one of them being saturated with silver chloride, a maximum potential difference of 0·423 volt was obtained. The results are thus in agreement with the theory. T. E.

Modifications of Common Galvanic Cells. By EMIL PETERSEN (*Zeit. Elektrochem.*, 1898, **5**, 261—265).—When the sulphuric acid in the Bunsen cell is replaced by a saturated solution of common salt, the E.M.F. is not altered, and the internal resistance is hardly changed; it is slightly increased if a solution of 4 parts of sodium nitrate in 5 parts of water is used. The nitric acid may be replaced by other oxidising agents, but the constancy of the cell suffers. A cell arranged as follows: Zn | NaCl solution (1 : 5), $FeCl_3,6H_2O$ solution (2 : 1) | carbon, has an E.M.F. of 1·72 volts. It will give a current of not more than 1 ampère for hours at constant E.M.F. The principal reaction is $Zn + 2FeCl_3 = ZnCl_2 + 2FeCl_2$; the secondary reaction, $3Zn + 2FeCl_3 + 6H_2O = 3ZnCl_2 + 2Fe(OH)_3 + 3H_2$, also occurs. When the ferric chloride is entirely reduced, the E.M.F. sinks to about 0·5 volt, and metallic iron is deposited on the carbon. The cell is now a very constant one of the Daniell type. If the porous cell is left out, the combination Zn | $FeCl_3$ solution | C gives 1·6 volts; Fe | $FeCl_3$ solution | C gives 0·9 volt. Potassium ferricyanide is an efficient substitute for the nitric acid in the Bunsen cell so long as no large amount of ferrocyanide is present. The E.M.F. diminishes gradually from 1·438 volts with pure ferricyanide to 1·105 volts with pure ferrocyanide. A convenient form of Daniell cell, in which magnesium chloride is used in place of zinc sulphate, is also briefly described. T. E.

Potential Difference between Amalgams and Solutions. By AUGUST SCHOELLER (*Zeit. Elektrochem.*, 1898, **5**, 259—261).—According to Nernst's theory, the difference of potential, *E*, between amalgams of an alkali or alkaline-earth metal of different concentrations, *C* and C_1, in contact with the same solution, is given by the formula $E = 0{\cdot}000198T/n \log C_1/C$, where *T* is the absolute temperature and *n* the number of electrical charges carried by an ion. The author prepares the amalgams by electrolysis of saturated solutions of baryta and of caustic soda. The concentration of the amalgam and the potential difference between it and the solution are then measured, and the results compared with those required by the theory, a very close agreement being found. It follows, therefore, that the solution tension of a metal dissolved in mercury is proportional to its concentration. The saturated solution of barium in mercury at 10° contains about 0·23 per cent. of barium. T. E.

Contact Potential between Metals and Melted Salts, and the Dissociation of Melted Salts. By CLARENCE MCCHEYNE GORDON (*Zeit. physikal. Chem.*, 1899, **28**, 302—312).—The E.M.F. was determined for cells consisting of silver electrodes immersed in two molten mixtures of silver nitrate in potassium and sodium nitrates, of different concentration as regards the silver nitrate. Temperatures of 232—236° were obtained by a quinoline bath, and of 298° by a diphenylamine bath, and the concentrations of the solutions examined were 1/0·1, 10/1, 50/10, and 100/50. The results for the two lower concentrations agreed completely with those calculated by Nernst's formula, and even for the high concentrations the difference only reached about 12 per cent. The dilute solutions are, therefore, almost completely dissociated, whilst from the values for the actual E.M.F. the values for dissociation in the 50 per cent. and 100 per cent. solutions are calculated as 0·69 and 0·58 respectively. This very high dissociation serves to explain the great conductivity of pure melted salts. L. M. J.

Chemical Proof of Concentration Change with Drop-electrodes. By WILHELM PALMAER (*Zeit. physikal. Chem.*, 1899, **28**, 257—279).—According to Nernst's theory, the concentration of the solution in the upper portion of a mercury dropping electrode should decrease whilst that of the lower liquid should increase, and experiments were made by chemical methods with the view of proving that these changes occur. The apparatus employed is described, the most noticeable feature being a new form of dropping tube, in which the mercury drops through about 100 fine, vertical grooves etched on the surface of a glass plug, and by the use of which measurable results are rapidly attained. The solution employed was N/0·0005 mercurous nitrate, which, however, contained a slight excess of nitric acid. In 5 minutes, the mercury concentration in the upper liquid had decreased in the ratio 0·42 : 1, and had increased in the lower liquid in the ratio 1·76 : 1, the similar ratios for the nitric acid being 0·87 and 1·11. The mercury was estimated by a colorimetric hydrogen sulphide method, and the nitrates by indigo solution. The results are in accord with Nernst's theory, but in no way contradictory to other theories of electrocapillary phenomena (compare Abstr., 1898, ii, 276). L. M. J.

Sources of Error in the Silver Voltameter. By K. KAHLE (*Ann. Phys. Chem.*, 1899, [ii], **67**, 1—36).—The author investigates the causes of the slight differences in the weight of silver deposited in two voltameters coupled up in series, and shows that, when both are treated in a similar manner, the difference is only about 1 part in 10,000. If the precipitate is washed with warm water, a loss in weight of about 1/4000 occurs, and it is found that a slightly smaller weight of silver is deposited on platinum than on a surface which is already coated with silver. If the same solution of silver nitrate is used in a large number of experiments, the weight of precipitated silver is about 1/1000 greater than when a fresh solution is used, and the precipitate separates in larger crystals; under these conditions, the solution becomes acid, and a similar increase in the weight of silver deposited is produced by the addition of acid to a freshly prepared solution, whilst the abnormal results disappear if the solution is shaken up with silver oxide. If a considerable quantity of acid is present (20 milligrams of HNO_3 : 1 gram $AgNO_3$), a brownish-violet precipitate is formed, which, when heated with water, becomes yellow at 30° and disappears at 40°; at the same time, the anode becomes brown instead of grey. This violet precipitate only forms in the part of the voltameter below the anode, and if the anode is placed in a separate vessel and connected by a syphon to the dish which forms the cathode, no such precipitate is produced; the formation of a coloured precipitate can also be prevented by shaking the solution with molecular silver. When silver oxide is added to the nitrate solution, the weight of silver deposited is 1/2000 greater than in a neutral solution.

In all these experiments, the current was adjusted so that no current passed through a Clark cell in parallel with a 4-ohm coil; the mean weight of silver deposited in 40 minutes was 0·9723 gram, and taking the electrochemical equivalent of silver as 1·118 mg. per coulomb, the E.M.F. of the Clark cell is found to be 1·4494 volts at 0°, and therefore 1·4330 volts at 15°. An indirect determination gave the E.M.F. of a cadmium cell at 20° as 1·0184 volts, and the ratio *Clark* 15°/*cadmium* 20° = 1·4066, whence the E.M.F. of the Clark cell at 15° = 1·4326. The mean E.M.F. is 1·4328 volts at 15° and 1·4492 volts at 0°.

The author has previously determined the absolute value of the E.M.F. of a Clark cell at 0° by means of Helmholtz's electrodynamometer, and obtained the value $E = 1{\cdot}4488$ volts (*Ann. Phys. Chem.*, 1896, [ii], **59**, 532); if this be taken as a standard, the electrochemical equivalent of silver is found to be 1·1183 mg. per coulomb.

T. M. L.

Electromotive Force required to Decompose Electrolytes By Emil Bose (*Zeit. Elektrochem.*, 1898, **5**, 153—177).—Further experiments on the lines of those of Glaser (this vol., ii, 78) are described; improvements in the experimental technique give the determinations greater accuracy than before. In a typical case, the curve connecting current and applied E.M.F. would consist of an almost horizontal line below the decomposition point, and of a more or less rapidly rising one above it. In reality, the two lines are joined by a curved portion instead of meeting at a sharp angle, and when the concentration of the ion which is being eliminated is small, the curve rises at first after the decomposition point is passed and then falls again. These peculiarities are shown to be due to changes of concentration near the small electrode. In solutions containing bromine and chlorine ions, the current increases so rapidly after the E.M.F. necessary for the separation of bromine is exceeded, that the further rise due to the separation of chlorine is not observed unless the concentration of the bromine ions is so small that the above mentioned fall occurs above the decomposition point for bromine. In all cases, a smaller E.M.F. is required to separate an ion from a concentrated solution than from a dilute one. The phenomena observed in separating silver and hydrogen ions from a solution of silver sulphate in dilute sulphuric acid, and silver and copper ions from an acid solution, were quite analogous to the foregoing. Copper ions require the same E.M.F. for their separation from solutions in sulphuric or in nitric acid. In this case, there are two decomposition points, due doubtless, to cuprous and cupric ions respectively, one of which lies about 0·1 volt above the other. Both points are displaced to the same extent by a change of concentration. This latter circumstance indicates that the equilibrium between them is represented by the equation $Cu + \overset{++}{Cu} \rightleftarrows \overset{+}{Cu} - \overset{+}{Cu}$.

Attempts to measure the E.M.F. required to separate mercurous ions from mercurous nitrate, using an oxygen saturated anode, gave values much lower than those calculated from the E.M.F. of galvanic cells. The discrepancy was traced to the rapid depolarisation of the oxygen anode by the mercurous nitrate solution.

Glaser's observation that, using a hydrogen cathode, 1·08 volts are required to separate $\overset{--}{O}$ ions from normal solutions of caustic soda or of sulphuric acid is confirmed. This point is not well marked, as is always the case where gaseous products are formed.

A very careful series of determinations of the E.M.F. required to separate silver ions from their charges, using a large platinised platinum anode saturated with oxygen at atmospheric pressure, gave the following results:—The concentrations of the solutions in gram-mols. per litre were: I, $1·75AgNO_3 + HNO_3$. II, $0·175AgNO_3 + HNO_3$. III, $0·0175AgNO_3 + HNO_3$. IV, $0·00175AgNO_3 + HNO_3$. V, $0·000175AgNO_3 + HNO_3$.

Temp.	I.	II.	III.	IV.	V.
0°			0·3452	0·3875	0·4528
20	0·2982	0·3205	0·3682	0·4255	0·4845
35	0·3041	0·3371	0·3916	0·4503	
50	0·313				

The increase of E.M.F. accompanying the dilution is in satisfactory agreement with that deduced from Nernst's theory.

The anodic decomposition points of a number of acids are also determined with reference to a hydrogen cathode. They all exhibit a first decomposition point at 1·67 volts, corresponding with the separation of $\overset{-}{OH}$ ions. The monobasic acids have one, and the dibasic acids two, other decomposition points at higher E.M.F.'s. In a few cases, the first decomposition is found much below 1·67 volts, owing to cathodic deplorisation; with chromic acid, this is especially well marked. Oxalic acid is exceptional; it gives a first decomposition point at

1 volt (due possibly to $\bar{C}_2\bar{O}_4$ ions), a second at 1·67 volts, due to $O\bar{H}$ ions, and a third at 2·15 volts, due possibly to $COOH\cdot\bar{C}OO$ ions. The paper concludes with a theoretical discussion of the changes of concentration, produced by the current in the neighbourhood of the electrodes and of their effect on the forces opposing the separation of the ions in the neutral state. T. E.

Electrolytic Behaviour of some Complex Fluorides and Oxyfluorides. By ARTURO MIOLATI and UGO ALVISI (*Real. Accad. Linc.*, 1897, ii, 376—381).—According to Werner, whose views on the constitution of inorganic compounds are briefly discussed, the number of groups or atoms with which an element is capable of uniting to form a complex ion never exceeds six. The formulæ of not a few compounds appear to contradict this theory, and the electric conductivity of some of these have been determined, in order to ascertain whether they really form exceptions to the rule. By the large increase of the conductivity with increasing dilution, the salts $(MoO_2F_5)(NH_4)_3$ and $(SiF_7)(NH_4)_3$ are shown to undergo hydrolytic dissociation, whereas the results obtained in the case of the compounds $(UO_2F_5)K_3$ ($\mu_{1024-32} = 29·6$, $\mu_\infty = 133·5$) and $(UO_2F_5)(NH_4)_3$ ($\mu_{1024-32} = 29·1$, $\mu_\infty = 133·1$) indicate the existence of stable complex ions, the composition of which is not readily reconcilable with Werner's views. The behaviour of the salts $TiF_6(NH_4)_2$, $MoO_2F_3(NH_4)$, $MoO_2F_4(NH_4)_2$, $MoO_2F_4K_2$, and $WO_2F_4K_2$ has also been studied, but as they are all decomposed by water to a greater or less extent, the results are considered to be of little value. N. L.

Conductivity of Electrolytes in Organic Solvents. By PAUL DUTOIT and L. FRIDERICH (*Bull. Soc. Chim.*, 1898, [iii], **19**, 321—337).—In order to obtain further knowledge of the relations which previous work (Abstr., 1897, ii, 546) has shown to exist between the conductivity of solutions and the properties of the solvent, the authors have investigated solutions of various electrolytes in acetone, acetophenone, acetonitrile, propionitrile, and butyronitrile. The conductivities were determined by Kohlrausch's method, the coefficients of viscosity by Ostwald's method, and the degree of association of the solvents by the method devised by Ramsay and Shields, which is based on a determination of the molecular surface energy. Full experimental details are given in the paper. For several electrolytes in acetonitrile and acetone solution, higher values are found for the molecular conductivity at infinite dilution than are observed in the case of aqueous solutions. This is especially the case with acetonitrile, a fact which is in perfect accordance with the high degree of polymerisation and the low coefficient of viscosity of this liquid. The behaviour of the binary electrolytes examined is quite analogous to that observed with aqueous solutions, the conductivity increasing with the dilution in accordance with Ostwald's law of dilution; the values obtained for μ_∞ are of the same order of magnitude, and the temperature coefficients are normal. In the case of the ternary electrolytes, however, the conductivity is low, not exceeding a fourth of the values found for binary electrolytes, and the behaviour of cadmium iodide is particularly abnormal. The molecular conductivity of the latter varies neither with the dilution nor with the temperature, and it is suggested that combination of the salt with the solvent may possibly occur. From a consideration of the results obtained by the authors and by other experimenters, the general conclusion is reached that when the same electrolyte is dissolved in different solvents, the values obtained for μ_∞ are direct functions of the degree of polymerisation, and inverse functions of the coefficient of viscosity of the solvent. N. L.

Fluidity and Electrolytic Conductivity of Salt Solutions, and the Conductivity of Oleic Acid and the Oleates. By Rudolf Dennhardt (*Ann. Phys. Chem.*, 1899, [ii], **67**, 325—344).—Ammonium nitrate, chloride, and bromide, and potassium bromide, iodide, chloride, and nitrate, show maxima of fluidity in aqueous solution (Sprung, *Ann. Phys. Chem.*, 1876, **159**, 399), but no such maxima are found in the conductivity; all these salts behave according to the ordinary law of dilution, except potassium bromide and iodide, the conductivity curves of which show a reversal of curvature.

Solutions of oleic acid in methylic alcohol show maxima of contraction at about 15 and 50 per cent., in ethylic alcohol at about 5 and 50 per cent., and in amylic alcohol at about 14 per cent. The specific conductivity exhibits a maximum at about 20 per cent. in methylic alcohol, and at 35 per cent. in ethylic alcohol, but a minimum in amylic alcohol at about 14 per cent. The molecular conductivity also exhibits maxima at 18 and 36 per cent. respectively in methylic and ethylic alcohols, and the temperature coefficients show minima at the same concentrations. The conductivity of alcoholic solutions of oleic acid increases slightly on keeping.

Aqueous solutions of sodium and potassium oleates differ from all other electrolytes in that the molecular conductivity exhibits a minimum value; for the potassium salt, this occurs at $c = 0{\cdot}03$ at 0°, and $c = 0{\cdot}01$ at 60°, and for the sodium salt at $c = 0{\cdot}01$ at 18° and 44°. The specific conductivity increases with the concentration, but more rapidly in concentrated than in dilute solutions, so that the conductivity-concentration curve is convex towards the axis of concentration; the abnormal increase which occurs is shown by comparison with potassium chloride, since at $c = 0{\cdot}01$ the oleate has only one-third the conductivity of the chloride, whilst at $c = 0{\cdot}4$ it is greater by one-half. No such minimum is found in alcoholic solutions, although an alteration in the curvature of the conductivity curve occurs at $c = 0{\cdot}01$; the conductivity is greater in a solution in methylic than in ethylic alcohol, but is less in an amylic alcohol solution.

The author explains the abnormal behaviour of aqueous solutions of the oleates as due to hydrolytic dissociation into an acid oleate and caustic soda, and at greater dilution into oleic acid and caustic soda. T. M. L.

Alloys of Iron and Nickel. By Floris Osmond (*Compt. rend.*, 1899, **128**, 304—307).—The following table (compare Abstr., 1894, ii, 283) gives the points of transformation of alloys of nickel and iron of varying composition.

Composition.			Disappearance of magnetism during heating.	Appearance of magnetism during cooling.
C.	Mn.	Ni.		
0·19	0·79	0·27	735°	715°
0·19	0·65	3·82	710	628
0·17	0·68	7·65	710	530
0·23	0·93	15·48	623	145
0·16	0·32	24·75	540	27
0·61	0·46	26·20	0	below 0
0·23	0·49	31·44	138	124
0·46	0·28	35·70	276	232
0·30	0·68	43·04	401	357
0·11	0·38	58·30	557	523
0·08	0·41	69·20	590	557
0·07	0·68	76·75	582	545
0·12	0·38	88·95	488	457
0·09	0·74	92·20	450	415
0·10	0·86	94·70	425	388
0·12	0·55	98·50	384	345

When the transformation temperatures for both cooling and heating are plotted against percentages of nickel, curves are obtained which in each case consist of three branches; these are widely separated for proportions of nickel between 0 and 25 per cent., but for greater percentages they lie closely together. In the heating curve, a wide break exists between the points corresponding with 24·75 and 26·20 per cent. of nickel. The minimum transformation temperature probably corresponds with the existence of an eutectic alloy, and the maximum with that of a partially dissociated compound, Ni_2Fe.

W. A. D.

Heat of Formation of Calcium Oxide. By HENRI MOISSAN (*Compt. rend.*, 1899, **128**, 384—387).—Crystallised calcium was enclosed in a small perforated platinum cylinder and immersed in water, which, under these conditions, attacks it regularly but completely, $Ca + 2H_2O = H_2 + Ca(OH)_2$ sat. sol., develops + 94·10 Cal. and hence,

$Ca + O = CaO$ solid develops .... + 145 Cal.
$Ca + O_2 + H_2 = Ca(OH)_2$ solid develops .... + 229·1 „
$Ca + O_2 + H_2 = Ca(OH)_2$ sat. sol. develops ...... + 232·1 „

The heat of formation of calcium oxide is higher than that of potassium or sodium oxides, and therefore, as the author has already shown, the former metal should displace either of the two latter; it is also somewhat higher than that of lithium oxide (+ 141·2 Cal.) and the author finds that calcium will displace lithium at a dull red heat. The fact that calcium will not displace magnesium from its oxide indicates that Thomsen's value (+ 143·4 Cal.) for the heat of formation of magnesium oxide is too low; his value for the heat of formation of calcium oxide is lower than that found by the author. C. H. B.

Thermochemistry of Azelaic Acid. By Gustave Massol (*Bull. Soc. Chim.*, 1898, [iii], **19**, 301—302).—The azelaic acid examined was obtained by the oxidation of castor oil, and after careful purification melted at 106·2°. The solubility in water of potassium hydrogen azelate is so small that its heat of dissolution could not be determined. The heat of dissolution of the normal salt, which crystallises with $1H_2O$, is +1·87 Cal.; when heated at 115°, it becomes anhydrous, and then dissolves in water with the development of +4·91 Cal. From the heat of neutralisation, $C_9H_{16}O_4$(solid) + 2KOH(diss.) = $C_9H_{14}K_2O_4$ (diss.) + 18·66 Cal., it is calculated that the heat of formation of normal potassium azelate is 41·53 Cal., all the substances concerned being in the solid state. This result is lower than that obtained in the case of suberic acid (44·76 Cal.) and sebacic acid (43·99 Cal.), but since the azelaic acid examined is not the normal acid, which has been variously stated to melt at temperatures ranging between 114° and 118°, it cannot properly be compared with the normal acids of the oxalic series which the author has previously studied (this vol., ii, 80). N. L.

Cryoscopic Behaviour of Orthonitrophenol. By G. Ampola and C. Rimatori (*Real. Accad. Linc.*, 1897, ii, 31—33).—Determinations of the depression of the freezing point of solutions of bromoform, veratrole, paraxylene, toluene, pyridine, aniline, phenol, thymol, isobutylic alcohol, tertiary butylic alcohol, benzylic alcohol, isobutyric acid, and acetic acid in orthonitrophenol show that the behaviour of the latter is analogous to that of phenol, normal depressions being obtained with neutral and basic substances, alcohols, and phenols, whilst acids behave abnormally. The mean molecular depression was found to be 74·37. In no case does the molecular depression increase with the concentration, as happens with ethylic veratrole oxalate in phenol, but always decreases with a rapidity greater than that found by Paternò with phenol solutions. N. L.

Heat of Formation of Sodium Meta- and Para-hydroxybenzoates. By Gustave Massol (*Bull. Soc. Chim.*, 1898, [iii], **19**, 250—251).—The author finds that the heat of dissolution of sodium metahydroxybenzoate is +0·26 Cal., and of the corresponding para-salt +0·32 Cal.; from these values and those given by Berthelot and Werner (Abstr., 1885, 1032) for the heats of neutralisation of the hydroxybenzoic acids, it follows that the action $C_7H_6O_3$ sol. + NaOH sol. = $C_7H_5O_3Na$ sol. + H_2O sol. develops + 17·77 Cal. in the case of the meta-acid and + 17·79 Cal. in the case of the para-acid. W. A. D.

Thermal Study of the Hydroxybenzoic Acids: Influence of the Phenolic Hydroxyl. By Gustave Massol (*Bull. Soc. Chim.*, 1898, [iii], **19**, 249—250).—The heats of formation of the solid sodium hydroxybenzoates produced according to the reaction acid sol. + NaOH sol. = salt sol. + H_2O sol. + Q., are as follows: sodium salicylate +19·15 Cal., sodium metahydroxybenzoate +17·77 Cal., and the parahydroxybenzoate +17·79 Cal. Since the heat of formation of solid sodium benzoate is +17·40 Cal., it follows that, although the phenolic hydroxyl enhances the acidimetric value of the carboxyl group in the case of the ortho-acid, it is almost without influence in those of the meta- and para-acids. These results are thus analogous to those already obtained by introducing a nitro- or a carboxyl group in different positions relatively to the carboxyl group of benzoic acid (*Ann. Chim. Phys.*, 1894, [vii], 1, 145, and Abstr., 1895, ii, 202). W. A. D.

Heat of Vaporisation of Piperidine, Pyridine, Acetonitrile, and Capronitrile. By WLADIMIR F. LUGININ (*Compt. rend.*, 1899, **128**, 366—369).—The determinations were made by the author's method at an altitude of 600 m. and under the atmospheric pressure of 715 to 725 mm.

Piperidine: specific heat between 19·5° and 97·5° = 0·5233; heat of vaporisation, –88·92 Cals.

Pyridine: specific heat between 21·5° and 107·6° = 0·4315; heat of vaporisation, –101·39 Cals.

Acetonitrile: specific heat between 20·7° and 76·4° = 0·5408; heat of vaporisation, –170·68 Cals.

Capronitrile: specific heat between 18° and 155·5° = 0·5417; heat of vaporisation, –88·09 Cals.

In all cases, the quotient, molecular weight × latent heat of vaporisation/absolute boiling point is about 20·0, and this indicates that the liquids consist of non-polymerised molecules—a conclusion previously arrived at by Ramsay and Shields in the case of piperidine and pyridine, as a result of their measurements of the surface tensions of these liquids. C. H. B.

Thermal Conductivity of Liquids. By EDMOND VAN AUBEL (*Zeit. physikal. Chem.*, 1899, **28**, 336—341).—According to Weber, the thermal conductivity of a liquid is given by the expression $k/c \cdot \sqrt[3]{V} =$ const. where k is the conductivity, c the thermal capacity of unit volume, and V the molecular volume. Lees' results (*Phil. Trans.*, 1898, **191**, 399) afford data for testing this relationship, and the values of the above constants thus obtained are (1) at 11°: water, 0·00390; acetic acid, 0·00339; (2) at 32°: water, 0·00343; glycerol, 0·00381; water-glycerol, 0·00320, so that the law is at best only an approximation. L. M. J.

Researches on Gases. By ANATOLE LEDUC (*Ann. Chim. Phys.*, 1898, [vii], 15, 5—114).—A detailed account of work already published (compare Abstr., 1897, ii, 133, 140, 549; 1898, ii, 20, 108, 215, 326, 331, 471). G. T. M.

Transition Points of Complex Systems as Fixed Points in Thermometry. By THEODORE W. RICHARDS and JESSE BRIGGS CHURCHILL (*Zeit. physikal. Chem.*, 1898, **28**, 313—316).—The authors have shown that the transition temperature of hydrated sodium sulphate is a convenient fixed point (Abstr., 1898, ii, 555); and Meyerhoffer and Saunders have also suggested the use of a mixture of sodium chloride and sodium sulphate for a normal room temperature (17·9°). The author considers it too low for this purpose (at least in America) and also that the use of a complex system is open to objection. The following transition temperatures may also be employed (temperatures given on hydrogen scale).

Sodium chromate	19·63°	Sodium bromide	50·7°
Sodium sulphate	32·38	Manganese chloride ...	57·7
Sodium carbonate	35·2	Trisodium phosphate	73·3
Sodium thiosulphate ...	47·9	Barium hydroxide ...	77·9

L. M. J.

Solidification of Liquid Mixtures of Tautomeric Compounds. By HENDRIK W. BAKHUIS ROOZEBOOM (*Zeit. physikal. Chem.*, 1899, **28**, 289—301).—Curves of composition plotted against temperature are given to illustrate the possible phenomena of solidification in the case of tautomeric liquids. The melting point curve consists of two lines, AC, BC, meeting in the eutectic point C. At higher temperatures are transition curves giving the final equilibrium composition when either of the compounds α and β is heated; these curves meet at a point F, above which only one liquid mixture is possible at any particular temperature. If a mixture is heated to a temperature x above F and rapidly cooled, the product first separating corresponds with that for the concentration at the point x, and finally the eutectic mixture results; if slowly cooled, however, the composition changes until the point F is reached and the product which separates first depends only on the composition at the point F. Similar cases, in which the temperature is not raised to the true equilibrium temperature of F, are considered, and are easily derived from the diagram. If the two liquids are further capable of forming a solid compound, the only differences are those due to the different form of the melting point curve, which consists of three curves with two minima in place of two curves with but one minimum. L. M. J.

Temperature Coefficients of Solutions of Salts in Mixtures of Alcohol and Ether. By CARLO CATTANEO (*Real. Accad. Linc.*, 1897, ii, 89—94).—In view of the fact, previously noticed by the author and since confirmed by other observers, that ethereal saline solutions are peculiar inasmuch as the electric conductivity decreases with rise of temperature, it seemed of interest to ascertain whether, by using a mixture of alcohol and ether as the solvent, solutions could be obtained having a conductivity independent of the temperature. A series of determinations made with ferric chloride shows that the point at which the temperature coefficient becomes zero depends, not only on the relative proportions of alcohol and ether, but also on the concentration. Thus, with solutions containing about 0·1 per cent. of ferric chloride, the neutral point is reached when the weights of ether and alcohol are in the proportion of 100 to 71—72, whilst with stronger solutions (about 1 per cent.) the ratio is 100 to 59—63. It is also shown that, in a long series of determinations, considerable errors may be introduced owing to evaporation of the solution and absorption of water from the air. Some experiments with auric chloride indicate that the neutral point is reached with a relatively smaller proportion of alcohol than is required in the case of ferric chloride. N. L.

Reciprocal Solubilities of Liquids; Vapour Pressure and Critical Points of Mixtures. By J. P. Kuenen and W. G. Robson (*Zeit. physikal. Chem.*, 1899, **28**, 342—365).—Rothmund has shown that in some cases of mutually soluble mixed liquids an upper, and in others a lower, critical temperature occurs at which the liquids are miscible, whilst in a few cases evidence was obtained of the probable existence of both points in a mixture (Abstr., 1898, ii, 503), and has led to the suggestion that the general form of the solubility curve is a closed curve. The system, however, is a three-phase system, and the critical point of the vapour phase and upper liquid may be reached before that of the two liquids, a case not considered by Rothmund. The forms of curves so obtainable are given, and in order to investigate such cases, the author determined the vapour pressure at temperatures reaching to the critical point in the case of various mixtures. With ether and water, an upper critical point for vapour and liquid was reached at 201°; the vapour pressure of the system was at all temperatures higher than that of the ether but less than the sum of the ether and water pressures. Mixtures of ethane and various alcohols were next examined. With methylic alcohol, the pressure of the system was at all temperatures intermediate between those of the two constituents, and hence the composition of the vapour does not lie between those of the two liquid phases; the critical point was reached at 35·37°. With ethylic alcohol, a lower critical point was found at 31·9° and a vapour | liquid critical point at 40·67°; with propylic alcohol, these temperatures become 38·67° and 41·7°, whilst with butylic alcohol they are 38·1° and 39·8°. In the case of the mixture with propylic alcohol, it was observed that increase of pressure could cause miscibility of the two liquid phases after condensation of the vapour phase. Mixtures with isopropylic alcohol behave similarly, but the lower critical temperature could not be accurately determined, whilst for isoamylic alcohol a three-phase temperature interval could not be found. A miscible mixture of ethane and water could not be obtained and the vapour | liquid critical point is almost identical with that of pure ethane. For carbonic anhydride and water, the critical temperature is somewhat lower than that of the pure anhydride, as would be expected from the fact that the three-phase pressure is less than that of the anhydride. L. M. J.

Phenomena of Physical Equilibrium in Mixtures of Isomorphous Substances. By Giuseppe Bruni (*Gazzetta*, 1898, **28**, ii, 322—333).—The depressions of the freezing point of a series of solutions of different concentrations of naphthalene in the isomorphous β-naphthol were determined. From the results, it is concluded that Küster's law—which states that for mixtures of two perfectly isomorphous substances the freezing point curve coincides with the straight line joining the freezing points of the two components—does not hold, but that the freezing point of the mixture varies between those of the two components continuously, but not proportionately to the concentration.

Using mixtures of the same two compounds, the distribution of the two components between the liquid and solid phases has also been determined, with results showing that the solid separating from the liquid mixture is richer in the component of higher melting point than the liquid. This is in direct opposition to the views of Küster, but is in complete accord with van't Hoff's general theory of solid solutions. T. H. P.

Significance of Osmotic Pressure in the Thermodynamics of Solutions. By NICOLAI N. SCHILLER (*Ann. Phys. Chem.*, 1899, [ii], **67**, 291—306).—A mathematical paper in which the author deduces expressions for the vapour pressure and heat of dilution of solutions, and for the heat of solution of gases. T. M. L.

Osmotic Pressure and Cryoscopy. By ALBERT REYCHLER (*Bull. Soc. Chim.*, 1898, [iii], **19**, 102—106).—According to Crompton (Trans., 1897, 925), van't Hoff's law requires modification in the case of associated solvents, and the osmotic pressure follows the equation $PV = xRT$, where x is the factor of association of the solvent. The author endeavours to show, by reasoning from fundamental principles, that the osmotic pressure is quite independent of the degree of association of the solvent, and contends that the facts adduced by Crompton in support of his theory are in full accordance with van't Hoff's law in its original form. N. L.

Osmotic Measurements. By A. PONSOT (*Bull. Soc. Chim.*, 1898, [iii], **19**, 9—10).—The mean of ten measurements of the osmotic pressure at 11·8° of a solution containing 1·235 grams of cane sugar per litre gave a value approximately equal to that calculated (870 mm.) on the assumption that the sugar is in the state of a perfect gas. It thus appears that, in very dilute, as well as in more concentrated, solutions (Pfeffer and Naccari), the coefficient i of van't Hoff's relation is equal to unity; and that Raoult's hypothesis of the dissociation of cane sugar in very dilute aqueous solution is not justified. This conclusion is supported by the cryoscopic values formerly obtained by the author (Abstr., 1898, ii, 55), which give the value $i = 1·004$. W. A. D.

Relation between Osmotic Work and Osmotic Pressure. By ARTHUR A. NOYES (*Zeit. physikal. Chem.*, 1899, **28**, 220—224).—The author has previously deduced an expression for the osmotic work, which may be stated as $\pi = Pv_0/(1 + P/_2k)$ (Abstr., 1897, ii, 395). This leads to the equation $dv = v_0(1 + P/_2 \cdot k)$, but the volume alteration is not capable of direct measurement from the volume change on dilution. The usually accepted thermodynamical relation between vapour pressure and osmotic pressure is not strictly accurate, inasmuch as it is assumed that when water is added to an infinite bulk of solution the volume change is infinitely small, an erroneous assumption, for although the pressure change become zero, yet the volume change for infinite volume may still be finite. Dieterici's calculation of the osmotic pressure from the density changes during dilution are not free from a similar error, and it is shown that the volume changes due to the removal of solvent at constant concentration, as deduced by Dieterici (*Ann. Phys. Chem.*, 1893, [ii], **50**, 67), do not agree with those calculated by the author's formula. L. M. J.

Measurement of Viscosity Coefficients. By Philippe A. Guye and L. Friderich (*Bull. Soc. Chim.*, 1898, [iii], **19**, 164—168).—Ostwald's apparatus is employed, and is calibrated by means of benzene, employing the viscosity constants obtained for this substance by Thorpe and Rodger (*Phil. Trans.*, 1894, **185**, 397). The coefficients of viscosity determined for the following liquids, pentane, hexane, carbon bisulphide, chloroform, and ethylic bromide, agree closely with those obtained by these observers, that for ethylic iodide differs somewhat, but the discrepancy is probably due to impurity and to the unstable nature of the substance.

Liquids closely related to one another in chemical constitution differ only slightly in density, whereas the coefficient of viscosity varies considerably. G. T. M.

Molecular Interchanges between Soluble Salts. By E. Roca (*Bull. Soc. Chim.*, 1898, [iii], **19**, 132—134).—When solutions of two salts, MA and M_1A_1, are mixed in molecular proportions, partial double decomposition occurs, in general, with production of four salts, according to the equation, $MA + M_1A_1 + Aq = (1 - m)MA + (1 - m)M_1A_1 + mM_1A + mMA_1 + Aq$. The fraction m depends on the dilution and on the temperature, and if these are such that m tends towards, and ultimately becomes equal to, unity, complete decomposition occurs according to the equation $MA + M_1A_1 = M_1A + MA_1$. In certain cases, of which the preparation of potassium nitrate and potassium chlorate are examples, the salts finally produced admit of separation by crystallisation; very often, however, the separation is, for various reasons, incomplete. Thus, if a solution containing ammonium sulphate and sodium nitrate is concentrated by evaporation, about three-fourths of the theoretical amount of sodium sulphate is first deposited, and then all the salts present crystallise out together; it is, therefore, impossible to prepare ammonium nitrate in this way. The author finds, however, that if the solution is evaporated to dryness and the residue exhausted with alcohol of 95—96 per cent., the sodium sulphate remains practically undissolved, and pure ammonium nitrate is obtained by concentrating the solution. It is suggested that, by operating in this manner with suitable solvents, a number of separations might be effected. N. L.

Energy of some Bases of Mixed Function. By Giacomo Carrara and U. Rossi (*Real. Accad. Linc.*, 1897, ii, 208—216).—The substance of this paper has appeared elsewhere (Abstr., 1898, ii, 278). N. L.

Velocity of Limited Reactions. By Paul Th. Muller (*Bull. Soc. Chim.*, 1898, [iii], **19**, 337—343).—The equation, $dx/dt = k_1(A - x) - k_2x$, representing a limited reaction of the first order, may be written $dx/dt = (k_1 + k_2)(a - x)$; that is, the velocity of the reaction is equal to that of an unlimited reaction of the first order if the limit, a, of the substance is taken for the initial active mass. Similarly, for limited reactions of the second order, the usual equation may be written,

$dx/dt = (k_1 - k_2)(a - x)(b - x)$, where a is the *chemical limit* of the reaction, and b, if positive, is numerically greater than a. The author has examined the results obtained by Berthelot and Péan de Saint-Gilles (*Ann. Chim. Phys.*, 1862, [iii], **19**, 83), and, more recently, by Knoblauch (Abstr., 1897, ii, 311), in studying the etherification of acetic acid and the hydrolysis of ethylic acetate, and finds that the course of the reactions is quite as well represented by the simple equation, $dx/dt = \lambda(a - x)$, where λ is constant, as by the more complex equation, $dx/dt = (k_1 - k_2)(a - x)(b - x)$. Since, however, in the reactions referred to, b is numerically much greater than a, the variations in the factor $(b - a)$ are very small, and in order to decide definitely between the two equations, it will be necessary to study reactions in which b exceeds a to as small an extent as possible. N. L.

Velocity of Reaction. By Alexander von Hemptinne and A. Bekaert (*Zeit. physikal. Chem.*, 1899, **28**, 225—240).—The influence of various media on the velocity of reaction of ethylic bromide with triethylamine was determined, the solvents employed being benzene, xylene, chlorobenzene, acetone, and methylic, ethylic, propylic, and benzylic alcohols with various mixtures of these liquids. It was found that, in mixtures of compounds of a similar nature, such as two alcohols, the velocity of reaction could be approximately calculated from that in each constituent, but in mixtures containing an alcohol with some other liquid, the velocity far exceeded that calculated from a mixture rule. The temperature coefficients, as deduced from the results obtained by the author and by Menschutkin, are approximately equal for benzene, acetone, chlorobenzene, and xylene, but are markedly less for the alcohols. A few ternary mixtures were also examined, and although the velocity was not calculable from those in the three constituents, fair agreement was obtained when calculated as a binary system, A + (B + C). L. M. J.

Chemical Reaction Velocities. By Svante Arrhenius (*Zeit. physikal. Chem.*, 1899, **28**, 317—335).—The author has previously suggested that many reactions such, for example, as the inversion of cane sugar, are brought about only with certain 'active' molecules, and that equilibrium exists between these active and the inactive molecules (Abstr., 1889, 1003). The enormous influence of the temperature on the velocity of inversion is most probably due to change in the number of active molecules. The velocity of inversion increases with the concentration of the sugar, and the author points out that this increase is approximately proportional to the increase of osmotic pressure per gram-molecule, and hence it is this osmotic pressure, and not the actual concentration, which should be considered in deducing reaction velocities. As foreign substances in general increase the osmotic pressure of a compound, they should also in general accelerate the velocities of reaction, which is actually the case. The velocity of inversion of sugar by acids is diminished by the addition of alcohol, but this does not necessitate a decrease of dissociation, as it could be also brought about by a change in the number of active molecules which is probably decreased by the alcohol just as the dissociation of weak electrolytes is diminished. There is no reason, therefore, to assume that conductivity experiments yield wrong values for the dissociation (Abstr., 1898, ii, 158), whilst Goldschmidt's values for the solubilities of silver acetate, propionate, and isobutyrate are in good accord with those calculated, if a correction which he overlooked (Abstr., 1898, ii, 152) is made for the change of dissociation with concentration. L. M. J.

Gases of the Argon-Helium Type, and the Periodic System. By Bohuslav Brauner (*Ber.*, 1899, **32**, 708—712).—The author discusses reasons for regarding the newly-discovered gases of the argon-helium type as inactive compounds or allotropic modifications rather than new elements. M. O. F.

Crystalline-Liquids. By Rudolf Schenck (*Zeit. physikal. Chem.*, 1899, **28**, 280—288).—Crystalline-liquids are regarded by Lehmann as crystals of extraordinarily small viscosity, whilst by Quincke (*Ann. Phys. Chem.*, [ii], **53**, 613) they are considered to consist of a multitude of minute, solid crystallites, each enclosed in a thin liquid film. If this were the case, that is, if the liquid crystals were not homogeneous, different transition temperatures should be found for different preparations and for the products crystallised from different solvents. Parazoxyanisoil was crystallised from (1) acetone, (2) alcohol, (3) chloroform, without any appreciable change of the transition point and the author hence considers Lehmann's view to be correct. Ostwald has suggested that the stability interval of crystalline-liquids must be near the critical point for solid and liquid, that is, the temperature at which the heat of fusion is zero. From the specific heats of the crystalline and isotropic liquids, the difference between the transition and critical temperatures is calculated as (1) 27·6° and (2) 18·4°; the difference in the values is perhaps due to dimorphism of the compound, and the author considers that similar determinations with other compounds are desirable (compare Abstr., 1898, ii, 286, 563). L. M. J.

Molecular Weights of some Inorganic Salts. By Nicola Castoro (*Gazzetta*, 1898, **28**, ii, 317—322).—The author has determined the molecular weights of several inorganic salts by the freezing point method, using as the solvent urethane, for which the molecular depression of freezing point has been found by Eyckmann to be 49·6°. At the melting point of urethane (about 49°), the molecular weights of silver nitrate and of mercuric, cadmium, zinc and stannous chlorides are in accordance with the ordinary formulæ, but cobalt and cupric chlorides have double molecular weights, corresponding with the formulæ Co_2Cl_4 and Cu_2Cl_4. Manganese chloride in dilute urethane solution shows a tendency to polymerise, the molecular weight being greater than the calculated value and increasing proportionally with the concentration. Acetamide was also tried as a solvent for inorganic salts, but the results were unsatisfactory. T. H. P.

Absorption of Water Vapour by Compounds and its Partition between two Similar and two Dissimilar Substances. By W. Busnikoff (*Chem. Centr.*, 1898, i, 492—494, 649—651; from *J. russ. chem. Ges.*, **29**, 482—524).—The rate of absorption of water by sulphuric acid was determined by placing the acid in a **Plattner's** desiccator containing water and weighing from time to time. The variations of temperature (from 18—23°) during the experiment appeared to have no influence on the character of the results. In the first experiment, in which 2·0638 grams of sulphuric acid of a composition corresponding with, $H_2SO_4 + 0·187H_2O$ were used, the acid acquired the composition of the hydrate, $H_2SO_4 + 0·5H_2O$, in 1·4 hours, of $H_2SO_4 + 1H_2O$ in 3·9 hours, and of $H_2SO_4 + 1·5H_2O$ in 6·7 hours. In the second experiment, in which 7·2814 grams of acid, corresponding with $H_2SO_4 + 0·337H_2O$, were used, the acid attained the composition $H_2SO_4 + 0·516H_2O$ in 4 hours, $H_2SO_4 + 1·140H_2O$ in 16 hours, $H_2SO_4 +$ 1·242 in 18 hours, and $H_2SO_4 + 2·792H_2O$ in 76 hours. The results show that the rate of absorption of water up to the formation of the hydrate, $H_2SO_4 + 5H_2O$, increases as the composition approaches that of a definite hydrate and then, after the formation of the hydrate, again decreases.

From experiments made by placing two portions of sulphuric acid of different concentrations in the same desiccator, it was found that the system did not attain a state of equilibrium until both liquids had acquired the same degree of hydration and then only if a definite hydrate could be formed. The amount, and perhaps also the rate, at which water is lost (or gained) is not dependent on the absolute quantity of the hydrate, but on its molecular weight.

The rate of absorption of water by calcium chloride was determined in the same way as in the case of sulphuric acid. The calcium chloride was melted in a stream of hydrogen chloride, and then brought into the desiccator; it forms an opalescent mass, in which crystals separate if moisture is excluded. If the limit of the formation of the hexahydrate is attained, no more crystals are formed. As in the case of sulphuric acid, the rate of absorption of water increases as the composition of a hydrate is approached, and then again decreases, and the break in the continuity of the curve lies between $CaCl_2 + 10H_2O$ and $CaCl_2 + 11H_2O$. In an experiment in which 6·3376 grams of $CaCl_2 + 0·820H_2O$ and 6·2872 grams of anhydrous calcium chloride were placed in the same desiccator, the composition of the former after 579 hours corresponded with $CaCl_2 + 0·794H_2O$, and that of the latter with $CaCl_2 + 0·127H_2O$. According to the author, there is a "critical hydrate," which is formed when the substance changes from the solid to the liquid state, and constitutes a point of demarcation between the absorption and the liberation of water.

In a system in which 10·3096 grams of $CaCl_2 + 35·12H_2O$ and 21·7316 grams of 96·67 per cent. sulphuric acid were placed in the same vessel, equilibrium was attained after 623 hours, and the composition of the liquids corresponded with $CaCl_2 + 2H_2O$ and $2H_2SO_4 + 5H_2O$ respectively. When 2·0638 grams of 96·67 per cent. sulphuric acid, which had been allowed to absorb 4·8274 grams of water and 6·8278 grams of anhydrous calcium chloride, were used, the system was in equilibrium after 2230 hours, and the liquids had the compositions $H_2SO_4 + 5H_2O$ and $CaCl_2 + 3H_2O$ respectively.

Similar results were obtained with barium chloride and sulphuric acid, and with magnesium chloride and sulphuric acid.

According to the author, the molecules forming the hydrates are arranged symmetrically, so that a section of the mass of the hydrate $CaCl_2 + 6H_2O$ would appear thus :

$$CaCl_2 - H_2O - H_2O - H_2O - H_2O - H_2O - H_2O - CaCl_2 - H_2O.$$
$$CaCl_2 - H_2O - H_2O - H_2O - H_2O - H_2O - H_2O - CaCl_2 - H_2O, \&c.$$

The crystalline form of the compound may depend on the angle between the corresponding molecules. The results show that the hydrates lose water when their molecular tension is greater than the tension of the surrounding water vapour, or *vice versâ*. E. W. W.

Oxygen Æolopile. By A. GAWALOWSKI (*Zeit. anal. Chem.*, 1899, **38**, 102—103).—This apparatus is very similar to the Russian blast lamp. A spherical wrought iron vessel is furnished with a long tubular neck which is so bent that its open end is immediately below the bottom of the vessel, points horizontally, and is narrowed to a blow-pipe orifice. The vessel contains a mixture for generating oxygen, and is heated by a suitable lamp. The jet of oxygen deflects a portion of the lamp flame, and furnishes a powerful horizontal blowpipe flame ; should a vertical flame be desired, a fireclay cone bent at right angles is placed in front of the jet. M. J. S.

Apparatus for Producing a Current of Warm Water of Constant Temperature. By J. J. L. VAN RIJN (*Zeit. anal. Chem.*, 1899, **38**, 96—99).—The principle made use of is identical with that of the ordinary hot water circulation apparatus employed in conservatories. A water reservoir, maintained at a constant temperature by a lamp controlled by a thermostat, is furnished with outflow and return pipes of caoutchouc, which are connected to the neighbouring instrument, the temperature of which is to be kept constant. M. J. S.

Apparatus for the Separation of Organic Products. By CAMILLE CHABRIÉ (*Bull. Soc. Chim.*, 1898, [iii], **19**, 100—102).—This apparatus, of which a figure is given, is intended to facilitate the mechanical separation, by decantation, of liquids of different densities, or of liquids from solids. Provision is made for the exclusion of air, condensation of vapour, collection of evolved gases, agitation of the substances, and maintenance of a constant temperature. N. L.

Inorganic Chemistry.

Action of Acids on Iodic Acid and Iodates. By PAUL CHRÉTIEN (*Ann. Chim. Phys.*, 1898, [vii], **15**, 358—432).—The greater part of this work has already appeared (compare Abstr., 1896, ii, 651 ; 1897, ii, 138). Phosphoric acid partially dehydrates iodic acid without combining with it ; but when iodic anhydride is added to hot phosphoric acid boiling at 150°, combination takes place, and on allowing the solution to cool, prismatic crystals of the complex *acid*, $P_2O_5,18I_2O_5,4H_2O$, separate. The salts of this acid are produced on adding iodic anhydride to a boiling solution of the corresponding phosphates in concentrated phosphoric acid; the following are obtained in this manner: *Potassium phosphiodate*, $P_2O_5,18I_2O_5,4K_2O + 5H_2O$, the *ammonium* salt of the same type crystallising with $12H_2O$, the *sodium* salt, $P_2O_5,18I_2O_5,6Na_2O + 5H_2O$, and the *lithium* salt, $P_2O_5,18I_2O_5,3Li_2O + 11H_2O$. Salts of this character could not be obtained with other metallic radicles.

Molybdiodic acid is obtained by dissolving molybdic dihydrate (2 mols.) in a dilute solution of iodic acid (1 mol.). Its salts are produced by the action of molybdic dihydrate on the corresponding iodates. The normal salts are of the type $I_2O_5,2MoO_3,RO$ (or R_2O), and *potassium*, *ammonium*, *sodium*, *lithium*, *barium*, *strontium*, *calcium*, *magnesium*, *zinc*, *cobalt*, *nickel*, *copper*, and *silver* salts corresponding with this formula are described. The following *acid* salts have also been obtained $(I_2O_5,2MoO_3)_3,4K_2O + 7H_2O$, $(I_2O_5,2MoO_3)_3,2K_2O + 13H_2O$, $(I_2O_5,2MoO_3)_2,K_2O + 4H_2O$, $(I_2O_5,2MoO_3)_3,K_2O + 7H_2O$, $(I_2O_5,2MoO_3)_4,3(NH_4)_2O + 6H_2O$, $(I_2O_5,2MoO_3)_4,3SrO + 15H_2O$, $(I_2O_5,2MoO_3)_3,ZnO + 16H_2O$, $(I_2O_5,2MoO_3)_5,2NiO + 15H_2O$, and $(I_2O_5,2MoO_3)_5,CoO + 18H_2O$. The *cadmium* and *manganese* salts correspond with the acid strontium salt, but crystallise with 15 and 9 of H_2O respectively. The *uranium* salt has the composition $4I_2O_5,3MoO_3,2U_2O_3 + 3H_2O$, and a complex *silver* salt, $4I_2O_5,3MoO_3,4Ag_2O$, is described.

The following derivatives of tungstiodic acid have been isolated: the *potassium* salt, $2I_2O_5,4WO_3,2K_2O + 8H_2O$, and the *ammonium* salt of like composition, but with $12H_2O$. G. T. M.

Fluoriodates. By RUDOLPH F. WEINLAND and O. LAUENSTEIN (*Zeit. anorg. Chem.*, 1899, **20**, 30—39).—*Potassium difluoriodate*, KIO_2F_2, obtained by evaporating a solution of potassium iodate, or iodic acid and potassium fluoride, in 40 per cent. hydrofluoric acid, crystallises in colourless tablets belonging to the rhombic system, [$a : b : c = 0{\cdot}9925 : 1 : 1{\cdot}4148$], and is isomorphous with ammonium iodate [$a : b : c = 0{\cdot}9948 : 1 : 1{\cdot}4335$]. It is stable in dry air and when kept under petroleum, but on exposure to the atmosphere decomposes into iodate and hydrogen fluoride; when heated in a tube, it melts to a colourless liquid, which quickly turns yellow and then decomposes into potassium fluoride with evolution of iodine, oxygen, and hydrogen fluoride. When treated with water, it dissolves, and is decomposed into potassium iodate and hydrofluoric acid; with warm sulphuric acid, it yields hydrofluoric acid, but concentrated sulphuric acid at − 10° is without action on the salt. It is easily recrystallised from 40 per cent. hydrofluoric acid. Potassium di- and tri-iodates, when treated with hydrofluoric acid, are decomposed into iodic acid and the normal iodate, and the latter is then converted into the preceding salt. The author was unable to obtain double salts of potassium difluoriodate with alkali haloids.

Ammonium difluoriodate separates in rhombic crystals, [$a : b : c = 0{\cdot}9871 : 1 : 1{\cdot}4107$], and is similar to the potassium salt. *Rubidium fluoriodate* is isomorphous with the preceding salts; [$a : b : c =$

0·9855 : 1 : 1·4423]. *Cæsium difluoriodate*, obtained together with a salt containing more fluorine, which separates out first, crystallises in the rhombic system; [$a:b:c = 1·1765:1:0·5603$]. The less soluble salt is apparently cæsium di-iodate, in which 2 oxygen atoms are replaced by 4 fluorine atoms; it crystallises in hydrated forms, but has not yet been obtained in a pure state. *Sodium difluoriodate* crystallises in thin, six-sided tablets.

Fluoriodates of metals which form sparingly soluble fluorides cannot be prepared by the above method, and fluorides are formed with separation of iodic acid. Iodic acid dissolves easily in hydrofluoric acid without decomposition, and when the solution is evaporated to a syrup, the iodic acid crystallises out unaltered. Potassium bromate, when warmed with hydrofluoric acid, is partially decomposed, with formation of bromine and oxygen; potassium chlorate crystallises without decomposition from hydrofluoric acid. E. C. R.

Selenium and Tellurium Compounds. By René Metzner (*Ann. Chim. Phys.*, 1898 [vii], **15**, 203—288).—An account of work already published. (Compare Abstr., 1896, ii, 642; 1897, ii, 132, 169, 488, 489; 1898, ii, 572; and this vol., ii, 20). G. T. M.

Synthesis of Hydroxylamine. By Ad. Jouve (*Compt. rend.*, 1899, **128**, 435—437).—When a mixture of 3 vols. of hydrogen with a little more than 2 vols. of nitric oxide is passed slowly over spongy platinum heated at 115—120°, a mixture of hydroxylamine and ammonia is formed. If the temperature is allowed to rise too high, or if the hydrogen is in excess, ammonia is the sole product, and in any case the yield of hydroxylamine is small. C. H. B.

Inorganic Hydrazine Salts and the Preparation of Hydrogen Nitride. By Alexander Sabanéeff (*Zeit. anorg. Chem.*, 1899, **20**, 21—29).—*Hydrazine dithionate*, $N_2H_4,H_2S_2O_6$, prepared from hydrazine sulphate and barium dithionate, crystallises in long prisms, is easily soluble in water, and decomposes after a time. When the solution is allowed to evaporate over sulphuric acid, it decomposes with separation of sulphuric anhydride, and is converted into a mixture of hydrazine sulphate and the normal salt, $2N_2H_4,H_2S_2O_6$; the latter is easily obtained by adding barium dithionate to a solution of hydrazine sulphate previously neutralised with hydrazine hydrate.

Hydrazine amidosulphonate, N_2H_4,HSO_3NH_2, is obtained by adding barium amidosulphonate to a neutral solution of hydrazine sulphate. The acid salt, $N_2H_4(HSO_3NH_2)_2$, could not be prepared, the products of the reaction being amidosulphonic acid and the normal salt.

The *double* salt, $N_2H_4,NH_3,H_4P_2O_6$, is obtained by neutralising a solution of hydrazine hypophosphate (Abstr., 1898, ii, 578) with ammonia, using methyl-orange as indicator. It separates in small crystals and is easily soluble in water.

[With A. Speransky.]—*Hydrazine pyrosulphite*, $2N_2H_4,H_2S_2O_5$, is obtained by passing sulphurous anhydride into an aqueous solution of hydrazine hydrate. When dissolved in water and neutralised with hydrazine hydrate, it is converted into the salt $2N_2H_4,H_2SO_3$. Both salts are easily oxidised and converted into the corresponding sulphates.

[With E. Dengin.]—*Hydrazine nitrate*, N_2H_4,HNO_3, obtained by neutralising hydrazine hydrate with nitric acid, using litmus as indicator, crystallises in long prisms when the syrupy solution is evaporated in a desiccator under diminished pressure, is somewhat soluble in absolute alcohol, crystallising from it in needles, has a faintly acid reaction, melts at 69°, begins to volatilise at 140°, is not decomposed at 300°, and explodes when heated over a free flame. When treated with concentrated sulphuric acid, a violent evolution of nitric oxide takes place; at - 16°, however, there is no reaction, and when warmed with dilute sulphuric acid, hydrogen nitride is formed. It reacts violently with phosphorus pentachloride, and is converted into hydrazine hydrochloride. The *acid nitrate*, $N_2H_4,2HNO_3$, obtained from barium nitrate and hydrazine sulphate, or by half neutralising hydrazine hydrate with nitric acid, crystallises in aggregates of needles or plates and is very unstable. When treated with absolute alcohol, it is converted into the normal salt. On heating rapidly, it melts at 103—104°, but begins to decompose at 80° when slowly heated, the products of the decomposition at 80—85° being hydrogen nitride, nitric acid, nitrogen, water, hydrazine nitrate, and ammonium nitrate. When heated on the water-bath, it yields hydrogen nitride (8 per cent.), nitric acid, nitrogen, and water, and a residue of ammonium nitrate, and when allowed to remain in a desiccator over sulphuric acid at the ordinary temperature, it decomposes into hydrogen nitride, hydrazine nitrate, and ammonium nitrate.

Hydrogen nitride is very easily prepared by cautiously warming a mixture of hydrazine sulphate (1·5 grams) and nitric acid of sp. gr. 1·3 (4 c.c.), and passing the gas into a solution of silver nitrate; the yield amounts to 10—12 per cent. of the weight of hydrazine sulphate employed. E. C. R.

Decomposition of Carbonic Oxide in Presence of Metallic Oxides. By O. Boudouard (*Compt. rend.*, 1899, **128**, 307—309).—The author has studied the rate of oxidation of carbonic oxide when passed over heated nickel and cobalt oxides at 445°, and finds that, in both cases, it is much more rapid than when ferric oxide is employed (this vol., ii, 287); as in the latter case, the amount of decomposition increases with the quantity of oxide used and with the time. In all these cases, the amount of carbon deposited is of the same order of magnitude as that of the oxide employed; when a large excess of purified carbon is mixed with the oxide, the results obtained are, on the whole, the same as those already described, but the action appears to take place more slowly. W. A. D.

Chlorination of Carbon Bisulphide in Presence of Aluminium Chloride. By A. Mouneyrat (*Bull. Soc. Chim.*, 1898, [iii], **19**, 262—263).—When a current of dry chlorine is passed into a cold mixture of carbon bisulphide (300 grams) with finely powdered anhydrous aluminium chloride (5 grams), the gas is totally absorbed, and the sole products of the reaction are carbon tetrachloride and disulphur dichloride. Carbon chlorosulphide, $CSCl_2$, which is formed when carbon bisulphide is chlorinated in the presence of iodine, is not produced, and it appears that the whole of the bisulphide is converted into the tetrachloride before any sulphur dichloride is formed. When a mixture of bromine and carbon bisulphide is heated with anhydrous aluminium chloride or bromide, carbon tetrabromide is formed, but the yield is small, and other reactions probably take place. N. L.

Electrolysis of the Alkali Chlorides. By F. WINTELER (*Zeit. Elektrochem,* 1898, **5**, 217—221. Compare F. Winteler, this vol., ii, 212, and F. Foerster, *ibid.*, 88).—Experiments on the electrolytic oxidation of sodium and potassium chlorates to perchlorates are described which confirm Foerster's results, and add a few details as to the effect of temperature and current density. T. E.

Preparation of Pure Silver. By OTTO PFEIFFER (*Chem. Zeit.*, 1898, **22**, 775).—Pure silver may be prepared by dissolving silver residues in strong ammonia, distilling off the excess of ammonia, and precipitating the chloride with hydrochloric acid. The washed chloride is then placed in a porous cell with dilute sulphuric acid, the cell being surrounded by the dilute acid. A plate of amalgamated zinc, immersed in the external acid, is connected by a platinum wire with a piece of platinum foil, placed in the porous cell, and the apparatus left for one or two days; the reduced silver, after washing with water, is used for the preparation of pure silver nitrate.

A. H.

Preparation of Pure Silver. By OTTO KUHN (*Chem. Zeit.*, 1898, **22**, 868. Compare preceding abstract).—Well washed silver chloride obtained from silver residues, is placed in a platinum crucible which is immersed in very dilute sulphuric acid contained in a porcelain basin. A piece of zinc is placed in the basin, touching the external surface of the platinum crucible, and the reduction allowed to go on for about forty-eight hours. The finely divided silver is then boiled with dilute sulphuric acid, well washed, and used for the preparation of silver nitrate. A. H.

Calcium Chloraluminate. By GEORGES FRIEDEL (*Zeit. Kryst. Min.*, 1899, **31**, 72—73; from *Bull. Soc. franç. Min.*, 1897, **20**, 122—136).—Hexagonal-shaped tablets of the composition $AlO_3Ca(CaCl),3H_2O + 2H_2O$, and sp. gr. 1·892, are formed when a mixture of precipitated alumina, calcium chloride, and calcium oxide with water is heated at 400—500°. The crystals lose $2H_2O$ at 105° without loss of transparency; this water can be regained from moist air; the remaining $3H_2O$ is only expelled at a red heat, with decomposition of the salt. The hexagonal-shaped crystals consist of three monosymmetric individuals twinned together; at a temperature of 35°, all trace of twinning disappears, and the crystals are then optically uniaxial. As the temperature falls, or as the water is reabsorbed in a crystal which has been heated at 80—100°, there is a return to the original conditions. A slight pressure applied to the crystals brings about twinning, which again disappears when the pressure is taken off. L. J. S.

Phosphorescent Strontium Sulphide. By JOSÉ R. MOURELO (*Compt. rend.*, 1899, **128**, 427—429).—The strontium sulphide, obtained from the carbonate by the action of sulphur vapour in absence of oxygen, is white and non-phosphorescent when the carbonate is pure and free from alkalis and calcite, but with strontianite the product is deep grey and is highly phosporescent. Other minerals containing strontium carbonate give less satisfactory results. Temperature has an important influence on the character of the product; if prepared at a dull or cherry-red heat, it is non-phosphorescent, and this holds good if prepared at a white heat, whilst a bright red heat gives the best result. The product obtained at too high a temperature does not become phosphorescent when re-heated (compare this vol., ii, 97 and 98.)

C. H. B.

Yttria Earths contained in Monazite Sands. By PAUL SCHÜTZENBERGER and O. BOUDOUARD (*Bull. Soc. Chim.*, 1898, [iii], **19**, 227—236 and 236—244).—The author denotes by the term "yttria earths" those earths which yield double sulphates with potassium sulphate and dissolve in a saturated solution of the latter, but are precipitated by oxalic acid or ammonium oxalate; they were separated by precipitating the soluble double sulphates with hot potash, dissolving in nitric acid, precipitating by ammonia, repeating the last two processes several times to remove all trace of alkali, and finally dissolving in nitric acid and precipitating with oxalic acid. The oxides obtained by igniting the mixed oxalates were then dissolved in nitric acid and converted into sulphates, which were fractionally crystallised a large number of times; the fractions, on analysis, gave values for the atomic weight of the metal varying from 94—111, but no value could be obtained which remained constant after repeated crystallisation. Crystallisation of the sulphates, therefore, does not afford a means of separating a pure earth.

The pure yttria earths were then converted into the nitrates, which were fractionally decomposed to form the sub-nitrates by heating at 315—325°; the unchanged normal nitrate was removed from each fraction by dissolving in water, whilst the sub-nitrate fractions were converted into sulphates and analysed. Results for the atomic weight of the metal were obtained which varied from 93·0 to 162·5, although in neither direction was a limit attained. The higher fractions probably contained holmium, ytterbium, and erbium, whilst the lower values probably corresponded with yttrium; the latter element, however, appears to be present only in very small quantity in the monazite sands, although it is noteworthy that the spark-spectra of all the fractions corresponded with that of pure yttrium. W. A. D.

Cæsium Manganese Alum. By AUGUSTO PICCINI (*Zeit. anorg. Chem.*, 1899, **20**, 12—15).—*Cæsium manganese alum* is obtained according to the method already described by the author (Abstr., 1898, ii, 521); the electrolysis of the mixed sulphates must be carried out at a temperature not exceeding 15°, and it is better to work at 0°. It crystallises in coral red, pentagonal hemihedric forms belonging to the cubic system, is decomposed by water and dilute acids with precipitation of manganese dioxide, gives a red solution in strong sulphuric acid (1 : 3), a yellowish-brown solution in concentrated nitric acid, and a brown solution in concentrated hydrochloric acid with evolution of chlorine; this solution becomes colourless on warming. The alum melts in its water of crystallisation at 40°, and cannot be dehydrated without decomposition. E. C. R.

Fluoromanganites. By **Rudolph F. Weinland** and **O. Lauenstein** (*Zeit. anorg. Chem.*, 1899, **20**, 40—45).—Potassium manganate dissolves to a violet solution in 40 per cent. hydrofluoric acid with evolution of heat, and on evaporation the solution yields a mixture of potassium permanganate and potassium fluoromanganite.

Potassium fluoromanganite, K_2MnF_6, obtained by dissolving potassium manganite (prepared by treating the manganate with water and carbonic anhydride) in hydrofluoric acid and potassium fluoride, crystallises in small, golden, transparent, hexagonal tablets [$a:c = 1:1·6414$]. It turns reddish-brown when cautiously heated, and recovers its original colour on cooling; at a higher temperature, it volatilises, and in contact with moist air yields a violet residue, hydrogen fluoride being evolved, whilst at a strong heat it is decomposed into oxides of manganese and potassium fluoride. It is decomposed by water with precipitation of hydrated manganese peroxide, dissolves in cold hydrochloric acid to a dark brown solution which evolves chlorine when heated; when treated with cold concentrated sulphuric acid, it yields hydrofluoric acid, and with warm acid, oxygen and ozone. With nitric acid, it yields manganese bromide and hydrofluoric acid, and no manganese goes into solution; this reaction distinguishes it from Christensen's manganese trifluoride potassium fluoride (Abstr., 1887, 335). It yields a brownish-red solution with phosphoric acid, is insoluble in glacial acetic acid, oxidises oxalic acid in aqueous solution, decolorises indigo solution, and with hydrogen peroxide yields a reddish residue with evolution of oxygen.

Rubidium fluoromanganite, Rb_2MnF_6, obtained by dissolving hydrated manganese peroxide in hydrofluoric acid and rubidium fluoride, crystallises in small, yellow, hexagonal tablets [$a:c = 1:1·6185$], and resembles the potassium salt.

The above salts are the first crystalline halogen compounds of quadrivalent manganese which have been described, manganese tetrachloride being stable only in ethereal hydrochloric acid at low temperatures. They belong to the same type as potassium silicofluoride, potassium telluribromide, and potassium platinochloride. E. C. R.

Absorption of Nitric Oxide by Ferrous Salts. By **Victor Thomas** (*Bull. Soc. Chim.*, 1898, [iii], **19**, 343—347. Compare Abstr., 1897, ii, 145 and 262).—Determinations of the amount of nitric oxide absorbed at different temperatures by known weights of ferrous chloride, bromide and iodide dissolved in water and in alcohol, show that the absorption is not proportional to the amount of iron present in the solution, but depends rather on the nature of the salt, and, as has been previously shown, on the nature of the solvent. Thus, the amount of nitric oxide absorbed per 100 parts of iron is greater for the chloride than the bromide, and for the bromide than the iodide. In the case of the latter salt, the temperature seems to have but little influence on the absorption, either for aqueous or alcoholic solutions.

N. L.

Preparation of Carbonatotetramminecobalt Hydrogen Carbonate. By Arturo Miolati (*Real. Accad. Linc.*, 1897, ii, 344—347). —In attempting to prepare carbonatotetramminecobalt thiocyanate by precipitating a solution of cobalt sulphate with the theoretical amount of barium thiocyanate and treating the filtered liquid according to Jörgensen's method, a red, crystalline salt was obtained, which analysis proved to be carbonatotetramminecobalt hydrogen carbonate. This production of the hydrogen carbonate, which Vortmann first obtained by saturating a solution of the normal carbonate with carbonic anhydride, is to be explained by its insolubility, as compared with the thiocyanate, under the experimental conditions. The author confirms Vortmann's description of the salt, but finds that, when heated at the temperature of the water-bath, it slowly decomposes and suffers a decrease in weight much greater than that corresponding with the loss of a molecule of water. Determinations of the electric conductivity of aqueous solutions gave the values $\mu_{32} = 59{\cdot}45$, $\mu_{1024} = 79{\cdot}18$, and $\mu\infty = 82{\cdot}6$; from these results, it is inferred that hydrolytic decomposition does not occur, and that the solution contains the salt of a dibasic acid with a univalent base, possibly the pyrocarbonate,

$$[Co(NH_3)_4CO_3]_2(CO_2)_2O.$$

N. L.

Action of Alkali Sulphites on Chromic Salts. By Albert Recoura (*Bull. Soc. Chim.*, 1898, **19**, [iii], 168—170. Compare Abstr., 1895, ii, 501, 1896, ii, 27, 172).—When sodium sulphite (3 mols.) is added to a solution of chromium sulphate (1 mol.), the liquid changes in colour from violet to green, and contains sulphurous acid, sodium sulphate, and a basic chromium sulphite. The *basic sulphite*, $2Cr_2O_3,SO_2$, is completely precipitated on boiling the green solution. Another *basic sulphite*, Cr_2O_3,SO_2, obtained in a colloidal form on evaporating this solution on the water-bath, dissolves in water, forming a neutral solution which yields a precipitate after a time or on the addition of salts such as potassium chloride. Chromic hydroxide is not precipitated immediately on the addition of cold alkalis to the green solution; the addition of excess of sodium sulphite retards the precipitation, but does not altogether prevent it. Even in this case, a rise of temperature, or the addition of a considerable excess of ammonia, causes a deposition of the hydroxide from the unstable product of the combination of chromium sulphite and sodium sulphite.

G. T. M.

Combination of Chromic and Titanic Acids. By Blondel (*Bull. Soc. Chim.*, 1898, [iii], **19**, 218).—Concentrated aqueous chromic acid dissolves titanic acid in different amounts depending on its concentration, temperature, and the method used in preparing the titanic acid; a concentrated solution containing 1 part of titanic oxide to 4 parts of chromic anhydride, when diluted with 8 parts of water at 50° or 6 parts of water at 100°, gives rise to a precipitate having the composition $3TiO_2,2CrO_3 + H_2O$; with 25 parts of cold water or 8 parts of water at 100°, the *compound* $2TiO_2,CrO_3 + 2H_2O$ is formed, whilst dilution with 50 parts of cold water or 12 parts of water at 100° yields the *compound* $3TiO_2,CrO_3 + 3H_2O$. On adding ammonia (1 equiv.) to the same concentrated solution of the two oxides, the *compound*

$2TiO_2,CrO_3 + 2H_2O$ is precipitated, and, on evaporating the mother liquor in a vacuum, the compound $TiO_2,3CrO_3,(NH_4)_2O + H_2O$ separates in hexagonal prisms. W. A. D.

Preparation of Pure Phosphotungstic Acid. By Ernst Winterstein (*Chem. Zeit.*, 1898, **22**, 539).—Pure phosphotungstic acid, free from alkali, is best prepared in the following manner. Sodium tungstate (4 kilos.) is dissolved in an equal weight of water and sodium phosphate (1 kilo.), dissolved in the boiling liquid. The solution is made slightly acid with sulphuric acid diluted with an equal volume of water, and evaporated until a crystalline crust forms, which disappears again on cooling. After some time, the syrupy liquid is poured off from the crystals of sodium sulphate, and extracted with ether, a small quantity of 70 per cent. sulphuric acid being added before each shaking. Heavy, oily, yellow drops of an ethereal solution of phosphotungstic acid collect at the bottom of the funnel and are removed, the extraction being continued until these no longer form. The ethereal extracts are united, water is added, and the whole extracted with fresh ether, the ether being distilled from the resulting solution in a current of steam. Chlorine is passed into the warm, dark coloured residue until it becomes light yellow, and, on cooling, the greater part of the phosphotungstic acid crystallises out, the remainder being obtained by evaporating the mother liquor. The yield amounts to about 2·3 kilos. with the quantities indicated. A. H.

Action of Hydrofluoric Acid on Bismuthic Acid and Potassium Bismuthate. By Rudolph F. Weinland and O. Lauenstein (*Zeit. anorg. Chem.*, 1899, **20**, 46—49).—When bismuthic acid is treated with 40 per cent. hydrofluoric acid at the ordinary temperature, a violent reaction takes place, and bismuth trifluoride is formed with evolution of oxygen and ozone. If, however, the reaction takes place at $-10°$, a very unstable fluorine compound of quinquevalent bismuth is obtained, which cannot be isolated; the solution has strong oxidising properties, liberates iodine from potassium iodide, or chlorine from hydrochloric acid, converts alcohol into aldehyde, and rapidly destroys organic substances. With traces of manganese salts, the solution gives a violet-red coloration; when concentrated in a vacuum, it yields bismuth trifluoride, and when it is extracted with ether or poured into a large quantity of cold water, the theoretical quantity of bismuthic acid is precipitated. Potassium bismuthate behaves in a similar manner when treated with hydrofluoric acid. E. C. R.

Mineralogical Chemistry.

Inflammable Gas in Metalliferous Mines. By Gustaf Nordenström (*Jahrb. f. Min.*, 1899, i, Ref. 262; from *Geol. För. Förh.*, 1896, **18**, 637—640).—Inflammable gas issuing from borings in the metalliferous mines at Ammeberg and Dannemora gave, on analysis by Särnström, the results under I and II respectively. The source of the gas is unknown, but it has certainly not been derived by the decay of wood-work in water, as is sometimes the case.

	CH_4.	C_2H_4.	CO_2.	CO.	H.	N.	Total.
I.	51·0	0·5	1·5	1·2	1·0	44·8	100·0
II.	33·6	—	—	—	—	66·4	100·0

L. J. S.

Strontianite from Bohemia. By C. Friedrich Eichleiter (*Verh. k.k. geol. Reichsanst.*, 1898, 297—298).—Analysis of strontianite from Lubna, near Rakonitz, gave

SrO.	CaO.	CO_2.	Fe.	Total.	Sp. gr.
63·97	5·15	30·95	trace	100·07	3·703

It forms sheaf-like or columnar aggregates, which are pale yellow on the exterior, but white and translucent inside. L. J. S.

Chalybite and Vivianite in Dutch Peat. By Jacobus M. van Bemmelen (*Jahrb. f. Min.*, 1899, i, Ref. 220; from *Archives Néerlandaises des Sci., Harlem*, 1897, **30**, 25—43. Compare this vol., ii, 302).—The peat of the moors in the south-east portion of the province of Drenthe, Holland, rests on alluvial sand and gravel cemented by siliceous and ferruginous material. The peat contains a relatively large amount of iron, with concretions and veins of white, amorphous chalybite, consisting of about 90 per cent. of $FeCO_3$, and 10 per cent. of organic matter, with small amounts of phosphoric acid, magnesia and alkalis. Vivianite, in nodules of grey-blue or blue colour, is associated with the chalybite, or encrusts twigs and roots; it contains about 60 per cent. of $Fe_3(PO_4)_2$ and $FeCO_3$ in the proportion of 2 : 1, and about 40 per cent. of organic matter.

It is suggested that the iron has been collected as oxide by organisms, and afterwards converted into carbonate; part of the latter being then acted on by solutions of calcium and ammonium phosphate (from animal remains) to form the vivianite. L. J. S.

Minnesota Minerals. By Charles P. Berkey (*Jahrb. f. Min.*, 1899, i, Ref. 228—229; from *Ann. Rept.* (1894) *Geol. and Nat. Hist. Survey, Minnesota*, 1895, **23**, 194—202).—The amygdaloidal diabase from Grand Marais, in the Lake Superior district, contains in the cavities, laumontite and strigovite with some quartz. The decomposed rock gave analysis I. Apophyllite crystals (anal. II; also trace of fluorine) are often intergrown with laumontite, to which is probably due the alumina shown in the analysis; sp. gr. 2·34. Laumontite (anal. III) occurs as fine needles. Strigovite (anal. IV) forms a thin coating on the walls of several of the amygdules.

	SiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	CaO.	MgO.	K_2O.	Na_2O.	H_2O.	Total.
I.	55·40	22·55	14·67	3·75	1·41	0·74	—	—	0·97	99·49
II.	52·61	0·67	trace	—	25·22	0·17	3·03	1·71	16·17	99·58
III.	53·87	18·06	0·88	—	11·19	0·45	0·29	0·67	13·18	98·59
IV.	33·14	13·22	24·20	12·19	1·50	3·49	—	—	12·34	100·08

Datolite occurs at Flood Bay, on Lake Superior, in snow-white, compact masses, with a very finely crystalline structure. H, 4½; sp. gr., 2·9. Analysis gave:

SiO_2.	Al_2O_3,Fe_2O_3.	CaO.	H_2O.	B_2O_3.	Total.
36·90	1·51	35·67	5·60	[20·32]	100·00

Analyses are also given of travertine and calcareous marl.

L. J. S.

Asbestos Deposits of Val Malenco. By LUIGI BRUGNATELLI (*Jahrb. f. Min.*, 1899, i, Ref. 211; from *Rend. R. Ist. Lombardo*, 1897, [ii], **30**, 1109—1119).—Minerals from the large deposits of asbestos in the Val Malenco, Lombardy, are described. The asbestos in fine white fibres is the chrysotile variety of serpentine.

A magnesium carbonate is found in compact, snow-white masses, which, under the microscope, is optically biaxial and apparently orthorhombic. Analysis gave:—

MgO.	CO_2.	H_2O.	Total.	Sp. gr.
43·32	21·85	34·32	99·49	2·001—2·025

This may be identical with the Vesuvian hydrogiobertite, or it may be a new mineral.

Crystallographic descriptions are given of magnesite, dolomite, aragonite, and magnetite; the last contains some titanium.

L. J. S.

Physiological Chemistry.

Fate of Carbonic Oxide in the Animal Body. By F. WACHHOLTZ (*Pflüger's Archiv*, 1899, **74**, 174—180).—The chief result of the experiments recorded is that the main portion of the carbonic oxide inspired is destroyed in the tissues, being converted into carbonic anhydride. Only so much is expired as such as can be explained by the relative tensions of the carbonic oxide combined as carboxyhæmoglobin, and that in the alveolar air. W. D. H.

Influence of Sodium Chloride on Proteid Metabolism. By WALTHER STRAUB (*Zeit. Biol.*, 1899, **37**, 527—549).—Seven experiments are recorded; they were made on dogs which were given a fixed diet, to which, on some days in the course of the observations, a certain quantity of sodium chloride was added. With small doses (3 grams), there was no effect on proteid metabolism; in one case, there was some diuresis. Even with larger doses (12 to 20 grams), the effect is a small one; there was certainly no marked increase of proteid metabolism, as some older observers stated. The first effect of these larger doses is a fall, followed by a rise, of proteid katabolism. This is mainly attributed to the salt's power of attracting water.

W. D. H.

Alterations of Concentration by the Diffusion of Two Substances in Solution into one another. Absorption in the Small Intestine. By RUDOLF HÖBER (*Pflüger's Archiv*, 1899, **74**, 225—245, 246—271. Compare Abstr., 1898, ii, 298).—The first of these two papers deals with the physical problems indicated by the title, and the second with the application of these principles to the elucidation of the subject of absorption. The general conclusion drawn is that in the absorption of salts there is no necessity to regard the process as due to the 'vital' action of cells; the diffusibility of salts determines their capacity for absorption. W. D. H.

Influence of Choline on the Circulation. By LÉON ASHER and HORATIO C. WOOD, jun. (*Zeit. Biol.*, 1899, **37**, 307—319).—In experiments made on dogs and rabbits, doses of 3 to 10 c.c. of a 5 per cent. solution of choline were injected intravenously; the main effects of these large doses are (1) a cessation of respiration, (2) an elevation of arterial pressure. These effects are considered to be due to the action of the base on the respiratory and vaso-motor centres respectively. W. D. H.

Absorption and Excretion of Iron in the Guinea-pig. By G. SWIRSKI (*Pflüger's Archiv*, 1899, **74**, 466—510).—The research is mainly histological, and deals with the kind of cells chiefly concerned in the absorption of iron in the guinea-pig. The iron reaction is obtained in the whole length of the alimentary canal with the exception of the stomach. In the duodenum, the iron-containing substance is in the form of fine granules, but this is not regarded as sufficient evidence that the duodenum is the only place where absorption of iron administered either in the food or in the form of drugs is absorbed, although that view is taken by some previous observers.

The iron reaction can be traced through the epithelium, the adenoid tissue beneath it and its cells, and the blood vessels. Certain forms of leucocytes which appear to be specially concerned in the process are designated "Fe-cytes."

In relation to the excretion of iron, the principal new point of interest raised is the possibility of excretion through the respiratory mucous membrane. W. D. H.

Urea in the Animal Organism, and in Normal Mammalian Muscle. Urea in various Animal Fluids. Formation of Urea in the Liver. By BERNHARD SCHÖNDORFF (*Pflüger's Archiv*, 1899, **74**, 307—356; 357—360; 361—363).—The main bulk of the first of this series of papers is devoted to a review of previous work on the subject; the last is polemical, and is directed against Salaskin, who has failed to find urea in mammalian muscle. The main point insisted on throughout is that urea is present in by no means insignificant amount in muscular tissue. The principal conclusions from the author's own experiments are the following:—

1. The various tissues investigated gave the following average results:

Blood contains	0·1157	per cent.	of urea.
Muscle ,,	0·0884	,,	,,
Liver ,,	0·1115	,,	,,
Kidney ,,	0·6695	,,	,,
Heart ,,	0·1734	,,	,,
Spleen ,,	0·1215	,,	,,
Pancreas ,,	0·1189	,,	,,
Brain ,,	0·1280	,,	,,

2. Bird's blood (goose) contains 0·0174 per cent. of urea. In mammalia, the amount rises with the amount of proteid in the food; the percentage in the blood of the pig, man on mixed diet, and dog on flesh diet are respectively 0·0284, 0·0611, and 0·120.

3. The amount of urea in human milk and human amniotic fluid is about the same as in the blood. The amount of proteid in human milk is given as 1·409 per cent.

4. Of the nitrogen contained in substances not precipitated by a mixture of phosphotungstic and hydrochloric acids, about 38 per cent. in goose's blood, and 50—60 per cent. in the animal fluids investigated, is present as urea. W. D. H.

Action of Superheated Water on Proteids. By ERNST SALKOWSKI (*Zeit. Biol.*, 1899, **37**, 404—416. Compare Abstr., 1898, ii, 173).—Polemical. A reply to Neumeister's criticisms (*Zeit. Biol.*, **36**, 420). W. D. H.

Chlorophyll in the Livers of Invertebratæ. By A. DASTRE and N. FLORESCO (*Compt. rend.*, 1899, **128**, 398—400).—When the dried and powdered livers of molluscs and other animals which are supposed to contain chlorophyll or xanthophyll are treated with chloroform, hæmochromogen remains undissolved, and the solution contains only hepatochlorophyll or hepatoxanthophyll, together with cholechrome, and the latter shows no absorption bands. The solution shows bands at λ670—646, λ548—530, λ520—507, and λ611—596; the first being the most distinct, and the last the weakest. The band at 524—507 is sometimes missing, even when the band at 611—596 is visible.

It is noteworthy that the three bands 670—646, 611—596, and 548—530 coincide with the bands I, II, and IV, of Tschirch's xanthophyll, and it follows that hepatoxanthophyll is identical with that of vegetable origin.

Direct experiments in which edible snails were kept for some time on a diet containing no chlorophyll showed that, under these conditions, the hepatochlorophyll disappeared, but reappeared when chlorophyllic substances were added to the diet. This fact, and the irregular occurrence of the hepatochlorophyll, show that it is really of vegetable origin, derived from the vegetable food of the particular animal, and is absorbed and tenaciously retained by the hepatic tissues.

C. H. B.

Reducing Power of the Tissues: Liver and Pancreas. By HENRI HÉLIER (*Compt. rend.*, 1899, **128**, 319—322).—The author measures the reducing power by boiling 5 grams of the fresh tissue with water for an hour, filtering, and diluting to 100 c.c.; 10 c.c. of the solution are then left for 24 hours with 25 c.c. of *N*/10 potassium permanganate, and, after filtering, are mixed with an excess of aqueous sulphurous acid containing a small quantity of sulphuric acid, and the excess finally estimated by means of very dilute permanganate solution. Whilst the reducing values so obtained are practically constant for the tissue of a dog's heart, they vary in a marked manner in the case of the liver and pancreas. Immediately after a meal, a high reducing value of the liver is observed, which gradually diminishes to less than one-half after 3 hours; a rapid increase then occurs, until after 10 hours it attains a maximum value greater than that first observed. In the case of the pancreas, similar results are obtained, but they are not so well defined. The influence of habit on the reducing power of the tissue is remarkable; when a guinea pig is fed 3 hours after its ordinary time and then killed 3 hours later, the reducing power of both liver and pancreas corresponds with that of the *sixth* hour under the ordinary conditions of feeding. The importance of considering this "functional memory" (*mémoire cellulaire*) in physiological research is thus emphasised.

W. A. D.

Sulphur in the Urine under Various Conditions. By ERICH HARNACK and FRIEDRICH K. KLEINE (*Zeit. Biol.*, 1899, **37**, 417—442).—The experiments recorded are considered to show that the estimation of sulphur in the urine gives a valuable indication of changes in the metabolic processes in the organism. The first series of experiments were performed on dogs; in their urine, sulphur is combined (*a*) as ordinary sulphates, (*b*) as ethereal sulphates, (*c*) as thiosulphates, and (*d*) as organic sulphur compounds. Dogs are very profoundly affected by chloral hydrate, and often small doses are fatal. The main effect on the sulphur in the urine is an increase of the 'neutral sulphur,' at the cost of the other sulphur-containing constituents of the urine.

In order to investigate the effects of alkalis, two grams of sodium carbonate were given daily with the food. This led to an increased combustion in the body, a marked decrease in the 'neutral' sulphur, and a corresponding increase of oxidised sulphur; there was also no storage of sodium compounds in the body. Small doses of soda abolish the action of chloral hydrate just described. Numerous observations on human beings in various pathological states are appended, but no general conclusions are drawn from these.

W. D. H.

The Sugar in Diabetic Urine. By GUSTAVE PATEIN and E. DUFAU (*Compt. rend.*, 1899, **128**, 375—377).—Various conflicting statements have been made as to the nature of the sugar in diabetic urine, and it is known that such urine may cease to contain glucose and then become lævogyrate. The author has endeavoured to throw light on these points by precipitating the proteids with an acid solution of mercuric nitrate followed by an excess of sodium hydroxide instead of with basic lead acetate. The sugar in the liquid was then estimated by means of the polarimeter, and also by Fehling's solution. Even when the polarimeter gives higher results than Fehling's solution, the sugar present is dextrose (*d*-glucose); when there is a difference between the results obtained by the two methods, it is due to the presence in the urine of lævogyrate compounds that are precipitated by mercuric nitrate in acid solution, but not by basic lead acetate.

C. H. B.

Chemistry of Vegetable Physiology and Agriculture.

Fermentation of Saccharides. By ELISÉE DUBOURG (*Compt. rend.*, 1899, **128**, 440—442).—Certain yeasts, when added to a solution of saccharose, produce no fermentation, but if they are added to a solution containing a high proportion of nitrogenous matter (for instance, 25 per cent. of an infusion of yeast), together with 5 per cent. of glucose and 5 per cent. of saccharose, the glucose and the greater part of the saccharose quickly disappear, and any sugar remaining is completely inverted. With less than 0·5 per cent. of glucose, however, this only disappears, and the saccharose is not attacked; with 1·5 to 2 per cent. both sugars are affected.

Under similar conditions and with suitable yeasts, even the sugars difficult to ferment, such as galactose, behave in the same way, but lactose always offers resistance. The results seem to be due to the production of a much larger quantity of the ferment in the highly nitrogenous liquid. If, after fermentation, the liquid is decanted, the residue is washed with sterilised water until free from sugars and a nutritive solution of saccharose is poured over it, the sugar is soon completely inverted and begins to ferment.

With moulds, on the other hand, under similar conditions, only those sugars are attacked that would be similarly affected by simple inoculation; lactose, raffinose, and saccharose do not ferment. It is noteworthy that the only two saccharides which are attacked by moulds, trehalose and maltose, yield glucose only when hydrolysed, and in this respect are analogous to starch, which is the only member of its group that will ferment with *Mucorinæ*. C. H. B.

Chemical Action of Pathogenic Micro-organisms. By LOUIS HUGOUNENQ and M. DOYON (*Ann. Chim. Phys.*, 1898, [vii], 145—156).—The action of pathogenic micro-organisms in promoting fermentation is observed by adding cultures to sterilised glucose solutions containing nutrient materials placed in contact with excess of calcium carbonate and maintained at 35° for a definite length of time. At the close of the experiment, the unaltered glucose is determined in one portion of the solution, the remainder is filtered, the precipitate examined for succinic acid, and the filtrate, acidified with oxalic acid, is distilled to remove alcohol and volatile acids. The final mother liquor is evaporated nearly to dryness, extracted with ether, and the extract examined for lactic acid.

Staphylococcus aureus produces small quantities of alcohol and inactive lactic acid; the gas evolved consists of carbonic anhydride and hydrogen; the greater part of the glucose remains unchanged.

Bacillus coli communis gives rise to both inactive and dextrorotatory lactic acids, ethylic alcohol, and a volatile acid not identified. An anærobic culture of the bacillus causes an evolution of hydrogen and carbonic anhydride. A similar result is obtained with the tetanus bacillus, whilst the latter gas and nitrogen are evolved in the case of Eberth's bacillus.

Streptococcus pyogenes and the cholera bacillus have little or no fermentative action.

Under favourable conditions, Eberth's bacillus and *B. coli communis* (compare Abstr., 1897, ii, 114) decompose the alkaline nitrates in 1½ per cent. solutions, setting free nitrogen and the corresponding alkali, and utilising the oxygen.

Biliverdin added to a nutrient solution containing *Staphylococcus aureus*, the septic vibrio, the cholera bacillus, Eberth's bacillus, or *B. coli communis*, is decomposed with the formation of a red colouring matter. Bilirubin under these conditions also undergoes decomposition, yielding the same product. The new colouring matter, unlike bilirubin and its derivatives, is soluble in water, and its solution is dichroic. Hæmoglobin is converted into hæmatin by the action of these organisms.

Outchinsky maintains that certain micro-organisms, cultivated in nutrient solutions containing no proteids, bring about the formation of active substances resembling albumin. The author, employing the solution recommended by this investigator, obtains negative results in the case of Löfler's bacillus and the bacilli of cholera and diphtheria.

G. T. M.

Production of Aromatic Substances by Alcoholic Fermentation in Presence of certain Leaves. By GEORGES JACQUEMIN (*Compt. rend.*, 1899, **128**, 369—371).—When the must of grapes is mixed with an aqueous extract of leaves from the same vine and then allowed to ferment, the wine obtained is superior in flavour and bouquet to wine obtained from the same must in the ordinary way. This result is due partly to the formation of aromatic compounds from the substances derived from the leaves (Abstr., 1898, ii, 397), and partly to the fact that the glucosides, &c., in the extract of the leaves promote the development of the most beneficial yeasts. The addition of the leaves themselves, instead of the extract, to the must does not give satisfactory results.

C. H. B.

Presence of Hydrocyanic Acid in Various Plants. By ALEXANDRE HÉBERT (*Bull. Soc. Chim.*, 1898, [iii], **19**, 310—313).—A number of plants, the reputed toxic properties of which have been attributed to the presence of hydrocyanic acid, were examined, having regard to the existence of the acid both in the free, or feebly combined, state and in the form of glucosides analogous to amygdalin.

Aroideæ.—No hydrocyanic acid was detected in *Arum maculatum*, *Arum Italicum*, *Arisarum vulgare*, *Amorphophallus rivieri*, *Caladium bulbosum*, and *Diffembrachia seguine.*

Saxifrageæ.—Hydrocyanic acid, in the free, or feebly combined, state, was found in the young, green shoots of *Ribes rubrum*, to the extent of a few milligrams per 100 grams; only traces are contained in the full-grown green parts of the plant. Smaller amounts of hydrocyanic acid occur in *R. nigrum* and *R. aureum*, but none was detected in *R. sanguineum* and *R. uva crispa.*

Rosaceæ.—Hydrocyanic acid is not contained in the cultivated varieties of *Rosa*. The embryo of the fruit of *Eryobothrya Japonica* yields about 0·04 per cent. of the acid, which results from the hydrolysis of a glucoside by a soluble ferment; it is not found in the pericarp or the seminal integument.

Ranunculaceæ.—The leaves, stalks, and buds of *Aquilegia vulgaris*, at the commencement of vegetation, yielded, per 100 grams, 1·2, 3·6, and 10·0 milligrams respectively of hydrocyanic acid, formed by the hydrolysis of a glucoside by a soluble ferment. The expanded flowers contain a much smaller quantity of the acid, which exists in the free, or feebly combined, state, and almost entirely in the ovaries (0·01 per cent.).

In none of the plants examined is there sufficient hydrocyanic acid to constitute a means of defence, or to produce serious toxic effects in ordinary circumstances. The fact that the acid occurs only in the chlorophyllaceous parts of *Aquilegia vulgaris* seems to confirm Gautier's views on the formation of proteids in plants. N. L.

Manurial Value of Oil Cakes. By L. MALPEAUX (*Ann. Agron.*, 1899, **25**, 111—126. Compare Abstr., 1897, ii, 383).—Field experiments were continued on the same lines as those previously described, and were supplemented by pot experiments with each manure. The results indicate that the different cakes act very differently; sesamé, as before, proved to be the best, whilst the values of the others decrease in the order: poppy, earth-nut, camelina, colza, castor-oil, cotton, and palm.

For spring sowing, cakes which act rapidly, such as poppy-seed, sesame, and castor-oil, should be employed, and they should be applied as early as possible. These cakes and camelina act more quickly than the others, which should be reserved for late crops.

The classification, as indicated by the author's experiments, is not absolute, and might have to be altered under different conditions of soil and season. N. H. J. M.

Action of Organic Nitrogen, especially in Farmyard Manure. By THEODOR PFEIFFER, E. FRANKE, OTTO LEMMERMANN, and H. SCHILLBACH (*Landw. Versuchs-Stat.*, 1899, **51**, 249—310).—The following results were obtained from two series of experiments, made in pots and on small plots, extending over three years.

Horn meal, blood meal, and dung gave, in the pot experiments, far better results than those obtained by Wagner, the values of the nitrogen (compared with nitrate = 100) being: horn meal, 83—84; blood meal, 85; and dung, 49, as against 63, 69, and 32 (Wagner). The after effect of the manures was very considerable.

One lot of farmyard manure which, in the pot experiments, gave the value 46, gave in two plot experiments the values 92 and 93 (nitric nitrogen = 100). The manure decomposes more quickly in soil under natural conditions than in pots, owing to the increased circulation of water and the resulting drying up of the surface.

In light, sandy soil (plots), the dung was effective with mustard in the second year, but not in the third year. In the case of the heavy soil at Rothamsted, the effect of farmyard manure is clearly visible after 23 years. This difference is attributed to the different rates of decomposition depending on aeration, and for this reason, results obtained with farmyard manure must be considered in conjunction with soil conditions.

Since the nitrogen of the dung applied to plots was utilised to an extent almost equal to nitrogen as nitrate, the manure cannot have caused denitrification to any extent, notwithstanding that in one case as much as 600 cwt. was applied per hectare.

In the case of the pot experiments, it is possible that, owing to imperfect aeration, there was a considerable loss of nitrogen in the free state, but it is doubtful whether such loss could have been great enough to account for the unsatisfactory results obtained.

N. H. J. M.

Field Experiments on the Effect of the Phosphoric Acid of Basic Slag and Bone Meal. By Emerich Meissl and Otto Reitmair (*Zeits. Landw. Versuchswesen Oesterr.*, 1898, **1**, 6—77).—The crops selected for the experiments were winter wheat and rye. The manures employed had the following percentage composition:

	Fine meal.	Total P_2O_5.	Solubility in citrate.
Basic slag I	82·4	18·03	93·5
,, ,, II	87·0	18·16	50·6
Bone meal	77·5	30·11	71·2

With regard to the effect produced by the two lots of basic slag, the results indicated that the phosphoric acid was equally valuable, both as regards the amount and the quality of the produce, notwithstanding the great difference in solubility in citrate. The general effect was to improve the relation of grain to straw, as compared with the unmanured plot; the percentage amount of phosphoric acid in the produce was not appreciably altered by the manure.

So far as autumn manuring is concerned—no spring manuring results are as yet available—the solubility of basic slag in citrate can no longer be considered as a criterion of the value of the manure. The older method of valuation, according to the amounts of fine meal and total phosphoric acid, seems to be the most satisfactory. At the same time, the citrate method is valuable in detecting adulteration with mineral phosphates. (Compare Dafert and Reitmair, this vol., ii, 382).

In comparison with basic slag, degelatinised bone meal gave, on the whole, better results as regards amount of produce, and equally good results as regards the quality of the crop. N. H. J. M.

Analytical Chemistry.

Measuring the Volumes of Liquids: Preparation of Normal Solutions. By Julius Wagner (*Zeit. physikal. Chem.*, 1899, **29**, 193—219).—The accuracy attainable in ordinary volumetric work and the probable errors resulting in the use of pipettes, burettes, and measuring flasks are discussed. The various methods of emptying pipettes were tested and all found capable of giving results accurate to 0·05 per cent., if care was taken to keep the time of outflow sufficiently great, practically no difference was found in the volume of different solutions delivered by a pipette. Measuring flasks can be used with a very high degree of accuracy if care is taken to dry the neck above the mark. All burettes require careful calibration, after which, for quantities above 20 c.c., the values are probably accurate to 0·05 per cent. Errors due to temperature variations are important; thus a change from 15° to 25°, if uncorrected, leads to errors of 0·2 to 0·3 per cent.; a table of temperature corrections is given. Examples are finally given to indicate the untrustworthiness of the commercial guarantee of purity of reagents. L. M. J.

Protection of Standard Solutions. By WILHELM STEINFELS (*Zeit. anal. Chem.*, 1899, **38**, 154—165).—When standard solutions which undergo alteration on exposure to atmospheric air (alkali hydroxides, stannous chloride) are stored in tubulated reservoirs from which the burettes are filled by opening a stopcock, they require to be protected by admitting the air through an appropriately charged U-tube. The author has devised a form of glass stopcock, and also an arrangement of caoutchouc tubes with a special pinch-clamp, by either of which the connection of the U-tube both with the reservoir and with the external air is opened and closed by the action which draws out the solution. The absorption of moisture from the solution and the deterioration of the protecting substance are thus almost completely prevented. Figures of the apparatus are given.

M. J. S.

Estimation of Fluorine and Carbonic Anhydride, and the Estimation of Fluorine in Teeth. By WALTHER HEMPEL and W. SCHEFFLER (*Zeit. anorg. Chem.*, 1899, **20**, 1—11).—The sample for analysis is mixed with finely-powdered quartz in the ratio of 15 parts to 1 part of fluorine, and treated with concentrated sulphuric acid under diminished pressure in a flask which is connected with a gas burette. Great care must be taken to ensure the absence of moisture from the apparatus. The mixture of silicon fluoride, carbonic anhydride, and other gases is measured and treated with water, to decompose the silicon fluoride, and the residual gas is again measured; the difference in the volume gives the volume of silicon fluoride. The carbonic anhydride is then estimated in the residual gas by absorption in potassium hydroxide, and the small quantity of carbonic anhydride which is absorbed during the treatment with water is collected by washing it out of the water by a stream of the residual gas from which the main quantity of the carbonic anhydride has been absorbed. The results are accurate, and an estimation of the fluorine can be performed in about 2 hours. A full description, with drawings of the apparatus, is given in the original paper.

Before estimating the fluorine in teeth, it is necessary to completely destroy all organic matter, since, in the subsequent treatment with sulphuric acid, it would cause the formation of sulphurous anhydride. This is easily effected by burning the finely-powdered teeth in a current of oxygen and no loss of fluorine takes place, provided that the pulverised teeth are in a very thin layer. The analysis of human teeth gave, for sound teeth, 0·33 and 0·52 per cent., and for unsound teeth, 0·19 per cent. of fluorine in the ash. E. C. R.

Estimation of Dissolved Oxygen in Water. By ALBERT LÉVY and FÉLIX MARBOUTIN (*Bull. Soc. Chim.*, 1898, [iii], **19**, 149—151. Compare Abstr., 1897, ii, 430).—The method for the estimation of dissolved oxygen in water, previously described by one of the authors, having been adversely criticised by Sokoloff, and also by Klopine, fresh experimental results are brought forward in support of the accuracy of the process, and it is pointed out that the objections raised against it are founded partly on mistranslations and partly on ignorance of various papers published in the *Annuaire de l'observatoire municipal de Montsouris*, more especially that of 1894. N. L.

Table for Calculation of Analyses of Fuming Sulphuric Acid. By LEO GRÜNHUT (*Zeit. anal. Chem.*, 1899, **38**, 167—171).—The results of acidimetric titration are expressed as H_2SO_4, and a reference to the table gives at once the percentage of sulphuric anhydride present. M. J. S.

Estimation of Nitrogen by Kjeldahl's Method. By LÉON MAQUENNE and E. ROUX (*Ann. Agron.*, 1899, **25**, 76—82).—In digesting the substance to be analysed with sulphuric acid, mercury, and potassium sulphate, it is necessary to continue the heating for half-an-hour after the liquid has become colourless, otherwise low results are obtained.

Addition of zinc before distilling is to be avoided, owing to the readiness with which nitrates are reduced to ammonia; pumice must only be used after it has been ignited and powdered. Check experiments should be made with all the reagents employed; as much as 3·65 milligrams of nitrogen as ammonia has been found in 20 c.c. of pure sulphuric acid. When caustic soda containing much carbonate is employed, there may even be (in check experiments) an increase in acidity, and to avoid this source of error it is proposed to insert a cup of wire gauze containing pumice in the neck of the distilling flask (which may be contracted at the base); when the alkali is poured into the flask, the pumice becomes saturated with it, and so retains any carbonic anhydride given off during the distillation.

The use of sodium sulphide for liberating ammonia from its compounds with mercury is objectionable as sometimes interfering with the titration; its action is, moreover, incomplete. Instead of it, the author employs sodium hypophosphite, a gram of which is measured in the dry state, in a spoon, dissolved in 20 c.c. of water, and added to the diluted, still acid solution. The reduction of the mercury salt is very rapid when the liquid is heated, a few minutes at 70—80° being sufficient. When cold, powdered pumice and alkali are added, and the analysis completed in the usual manner.

There is no object in continuing the distillation for more than half-an-hour; in this time, the distillate amounts to about 45 c.c. Results of several analyses are given, showing that somewhat higher results are obtained when sodium hypophosphite is employed than with the sulphide. N. H. J. M.

Simple Addition to the Apparatus for Kjeldahl Nitrogen Estimations. By Fritz Pregl (*Zeit. anal. Chem.*, 1899, **38**, 166—167).—The object of this addition is to prevent regurgitation of the standard sulphuric acid in the absorption flask in case of any accidental diminution of pressure in the distillation flask. A simple trap, consisting of a small glass bulb with a tubular neck continued internally nearly to the bottom of the bulb, and plunging to a depth of about 2 mm. into mercury in the bulb, is passed through the caoutchouc stopper of the distillation flask. There is a hole in the side of the bulb near the top. Should diminution of pressure occur, air enters through the trap, but the mercury prevents any escape in the opposite direction. When this trap is used, the distillation requires no attention whatever. M. J. S.

Reactions for the Detection of the Nitro-group. By S. P. Mulliken and E. R. Barker (*Amer. Chem. J.*, 1899, **21**, 271—276).—All nitro-compounds, when dissolved in dilute alcohol containing traces of some neutral salt, such as calcium chloride, are readily reduced by zinc dust to hydroxylamino-derivatives (compare Bamberger, Abstr., 1894, i, 373; and Wöhl, *ibid.*, 409). As a qualitative test, the reaction is best applied by dissolving 3 or 4 drops of the nitro-compound in 3 c.c. of 50 per cent. alcohol, adding 5 or 6 drops of a 10 per cent. calcium chloride solution, and then heating until violent boiling begins; the mixture is then left for 2—5 minutes, filtered, and the filtrate tested with ammoniacal silver nitrate, the presence of a nitro-compound being shown by the strong reducing power of the solution. Nitroso-, azo-, and azoxy-derivatives give the reaction.

Nitrobenzene, in the presence of a little iron and hydrochloric acid, acts as an oxidising agent in the conversion of "aniline-red oil" (a mixture in equal parts of aniline, and ortho- and para-toluidines) into rosaniline, and, as Lange showed (Abstr., 1885, 1130), any other nitro-compound may be substituted for nitrobenzene in the reaction. Three or four drops of the nitro-compound are boiled for 2—3 minutes in a test-tube with 2 c.c. of "aniline-red oil," 2 c.c. of distilled water, 2 c.c. of concentrated hydrochloric acid of sp. gr. 1·20, and 1 gram of iron filings, an excess of acid being carefully avoided, as it prevents the appearance of the colour. The red colour of the rosaniline is best observed by pouring a few drops of the dark-coloured liquid into dilute acetic acid. The "aniline-red oil" used should be nearly colourless. The coloration is not very marked with di- or tri-nitro-compounds. In addition to nitro-compounds, any substance containing oxygen directly attached to nitrogen, as, for example, azoxybenzene, nitrosobenzene, methylphenylnitrosamine, acetoxime, and ethylic nitrite or nitrate, gives the reaction. J. J. S.

Valuation of Basic Slag. By Franz W. Dafert and Otto Reitmair (reprinted from *Zeits. Landw. Versuchswesen Oesterr.*, 1899, 2, pp. 25).—Whilst the results of Meissl and Reitmair's experiments (this vol., ii, 379) indicated that it is wrong to value basic slag according to the solubility in citrate rather than according to the total phosphoric acid, subsequent experiments made in pots (Reitmair, *Zeits. Landw. Versuchsw. Oesterr.*, 1899, **2**, 24) showed a relatively good agreement between the amount of phosphoric acid taken up and the solubility in citrate or citric acid. Without underrating the importance of these results, which accord with those obtained by Wagner, it is pointed out that, in practice, increased yield of corn and straw is what is wanted. From this point of view, it is maintained that the results of these and of Wagner's experiments indicate that it is, as a rule, the amount of total phosphoric acid in basic slag on which the yield of corn and straw depends, whilst the completeness and rapidity of the action depend on the fineness and on the chemical nature of the slag. The solubility of the phosphoric acid in dilute acids gives, within certain limits, very useful indications as to the value of the slag; but Wagner's citrate solubility method is not, *per se*, entirely trustworthy as a means of ascertaining the practical value of the manure.

After trying a number of solvents, it was found that a 5 per cent. solution of formic acid furnished results which agreed best with the production of corn. It is therefore proposed that basic slag should be valued according to the total phosphoric acid when 90 per cent. of the total is soluble in 5 per cent. formic acid.

Estimation of Total Phosphoric Acid.—Ten grams of the slag are boiled for 15 minutes with 100 c.c. of nitric acid of sp. gr. 1·4 in a half-litre flask; water (300 c.c.) is then added, and the solution, after cooling, is diluted to 500 c.c. Of the filtered solution, 25 c.c. are mixed with 20 c.c. of nitric acid in a beaker, without using a rod, and, while lukewarm, 75 c.c. of a concentrated molybdate solution are quickly added. After 5 minutes, the mixture is stirred violently for a whole minute. In about half-an-hour it is filtered, washed with a mixture of the concentrated molybdate solution (1 part) and water (20 parts), dissolved in 2·5 per cent. ammonia, and precipitated with magnesia mixture.

The molybdate solution is prepared as follows:—Powdered ammonium molybdate (400 grams) is dissolved in hot water (about 650 c.c.), diluted to 1000 c.c., and after quickly cooling to 20°, again made up to a litre. Ammonium nitrate (200 grams, previously weighed) is then added to 870 c.c. of nitric acid (sp. gr. 1·300 at 15°), stirred violently until the temperature falls to about 10°, and the whole immediately poured, in a thin stream, into the molybdate solution, which is violently stirred all the time. After being kept for 48 hours at 20—30° in a good light, the solution is filtered, and kept in a cool, dark place.

The magnesia mixture is a solution of crystallised magnesium chloride (55 grams) and ammonium chloride (70 grams) in 1 litre of 2·5 per cent. ammonia.

Estimation of Phosphoric Acid Soluble in Formic Acid.—Five grams of the slag, in a 500 c.c. flask, are moistened with alcohol (5 c.c.), the flask filled to the mark with 5 per cent. formic acid, and rotated for 30 minutes in a Wagner apparatus; 75 c.c. of the filtered extract are poured into a pear-shaped vessel terminating in a cylinder with 0·1 c.c. divisions, and treated with 75 c.c. of the molybdate solution. The cylinder is closed, kept upright for 5 minutes, and shaken upside down as violently as possible for half a minute. After a few minutes, when most of the precipitate has deposited in the cylinder, any portions of the precipitate adhering to the cork are washed down into the liquid, and the whole kept upright for 2 hours; it is then shaken in the machine for 15 minutes, allowed to settle for an hour, and the volume of the precipitate read off. The number of c.c., multiplied by a factor to be determined, gives with sufficient accuracy the amount of phosphoric acid dissolved.

The factor is obtained by determining gravimetrically the amount of soluble phosphoric acid in a number of samples for which the above method has been employed. The results of actual determinations, being divided by the corresponding volumes of precipitates, yield an average value which is taken as the factor. The factor does not depend on the process if carried out exactly as described, but does depend, to some extent, on the form of the pear-shaped vessel. The method is applicable to any extracts of slags.

N. H. J. M.

Estimation of Carbonic Oxide. By CHARLES FRÉDÉRIC SCHLAGDENHAUFFEN and PAGEL (*Compt. rend.*, 1899, **128**, 309—311).—When carbonic oxide is slowly passed over carefully dried silver oxide at 60°, it is completely converted into carbonic anhydride, and the method can be employed for its estimation. Dry cuprous oxide is not acted on by carbonic oxide at 100°, but at higher temperatures is reduced to metallic copper, the conversion of carbonic oxide to anhydride being complete at 300°. Dry bismuth oxide remains unaltered in presence of carbonic oxide at temperatures below 230°, but at 400° it is reduced to the lower oxide without yielding the metal; red lead commences to undergo change at 225°, whilst litharge is only acted on at temperatures above 300°, metallic lead being formed. W. A. D.

Estimation of Potassium in Fertilisers. By CARL G. EGGERTZ and LARS F. NILSON (*Zeit. anal. Chem.*, 1899, **38**, 172—173; from *Kongl. Landtbruks-Akad. Hand. och Tidskrift*, **35**, 326).—The authors have endeavoured to clear up the discrepancies which Atterberg and others (Abstr., 1897, ii, 160) assert to exist between the results of the Stassfurth and the Swedish methods of estimating potassium, and find that both methods, when applied to kainite, give closely concordant results. In assaying calcined salts, the differences are slightly greater, but still quite unimportant. They attribute the lower results obtained in Sweden mainly to the fact that the Stassfurth salts, especially after calcination, are highly hygroscopic, and insist on the necessity of estimating moisture in all cases. A defect in both methods, however, is that the substance is dissolved by dilute hydrochloric acid, whereas it has been agreed, by the meeting of German chemists at Kiel in 1895, that only the potassium soluble in water should be estimated; the insoluble portion should therefore be removed before acidifying. The quantity of acid prescribed in the Swedish method (1 c.c. of dilute acid to 10 grams of substance) is insufficient, and permits a considerable amount of potassium to adhere to the precipitate of barium sulphate obtained when freeing the solution from sulphates; the substitution of 1 c.c. of fuming acid for this quantity is recommended. To test the weighed platinochloride for impurities, they treat the weighed precipitate with 1 c.c. of water of atmospheric temperature, remove this instantly by suction, wash with 1 c.c. of absolute alcohol, and lastly with 1 c.c. of ether, evaporate the solution, and dry for 10 minutes at 130°. A larger residue than 7 milligrams indicates impurities. M. J. S.

Estimation of Calcium Carbonate in Marl and Soil. By Adolf Mayer (*Landw. Versuchs-Stat.*, 1899, **51**, 339—340).—The usual method, depending on the liberation of the carbonic anhydride which is then estimated from the loss in weight or else gravimetrically or gasometrically, generally gives satisfactory results. Varieties of marls exist, however, which contain more or less ferrous carbonate and some even effervesce, when treated with hydrochloric acid, although only traces of calcium carbonate are present.

Satisfactory results are obtained when acetic acid (diluted with two parts of water) is used instead of hydrochloric acid; with pure lime marls, results are obtained with Scheibler's apparatus agreeing with those obtained with hydrochloric acid, whilst ferrous carbonate is not appreciably attacked. The marl must be finely powdered.

The modification is of great practical importance, since by it the presence of impurities in marl is readily detected; marls containing ferrous carbonate are quite unsuited for applying to the land, as the ferrous salt would utilise the oxygen of the soil and thus diminish its neutralising power towards weak acids. N. H. J. M.

Formaldoxime as an Agent for detecting Traces of Copper. By A. Bach (*Compt. rend.*, 1899, **128**, 363—365).—Formaldoxime hydrochloride, $(CH_2{:}NOH)_3,HCl$, obtained by the action of formaldehyde on hydroxylamine hydrochloride, or of trioxymethylene on hydroxylamine hydrochloride, and identical with that described by Dunstan and Bossi (Trans., 1898, 353), gives a very intense violet coloration even with very dilute solutions of cupric salts, and can detect one part of cupric sulphate in 1,000,000 parts of water.

The reagent is prepared by adding a molecular proportion of hydroxylamine hydrochloride to formaldehyde in solution (1 : 5); after mixing it with the copper solution, a slight excess of potassium hydroxide should be added. The colour is somewhat similar to that produced by biuret, and it is noteworthy that the product of the action of concentrated formaldehyde solution on solid potassium cyanide gives the biuret reaction. C. H. B.

Estimation of Mercury in Organic Liquids, and especially in Liquids fermented in presence of Mercuric Chloride. By A. Gayon and L. Laborde (*Ann. Agron.*, 1899, **25**, 142—143; from *Rev. Viticult.*, **10**, 177).—The wine (1 litre) is heated with pure nitric acid (150 c.c.) until the action becomes vigorous, when heating is discontinued. When cold, the clear yellow liquid is submitted to electrolysis, and in about 12—15 hours the whole of the mercury is deposited. This is redissolved in a few c.c. of pure nitric acid, with the aid, if organic matter is present, of potassium chlorate (0·1—0·2 gram) and a few drops of hydrochloric acid; a little water is then added and the chlorine expelled by boiling. The cold solution is either neutralised with ammonia or is treated with ammonium acetate and acetic acid, and titrated with stannous chloride.

It was found in every case that, after fermentation, only minute traces of mercury remained in solution; the rest, having been rendered insoluble, was found in the deposit. It is concluded that newly made wines from the grapes of vines treated with salts of mercury contain only harmless traces of mercury (compare De Cazeau, *Ann. Agron.*, 1898, **24**, 42). N. H. J. M.

The Amount of Carbon in Electrolytically Deposited Iron. By Hans Verwer and Friedrich Groll (*Ber.*, 1899, **32**, 806—809).—The authors do not agree with the conclusions of Avery and Dales (this vol., ii, 251), that the use of ammonium oxalate in the electrolysis of iron salts causes the separation of carbon at the cathode and, further, leaves some of the iron unchanged in the solution. They have carried out a number of experiments, and find that in no case is the percentage of iron too high, and that the solution after the electrolysis does not contain unchanged iron salt. J. F. T.

Electrolytic Estimation of Nickel in presence of Iron. By B. Neumann (*Chem. Zeit.*, 1898, **22**, 731).—In order to avoid the repeated dissolution and reprecipitation needful in separating iron and nickel by ammonia, it has been proposed to precipitate the nickel by electrolysis from the ammoniacal nickel sulphate solution containing suspended ferric hydroxide. The nickel thus obtained is shown to contain an amount of iron which varies with the quantity of iron suspended and with the duration of the electrolysis. If ferrous iron is present, the quantity in the nickel deposit is much increased. The following process is sufficiently accurate for technical purposes: 5 grams of nickel steel are dissolved in dilute sulphuric acid, the iron oxidised with hydrogen peroxide or bromine, and precipitated by ammonium sulphate and ammonia. After boiling, excess of ammonia is added and the solution diluted to 500 c.c.; 100 c.c. are filtered off, warmed to 50—60°, and electrolysed with a current density of 1 to 2 ampères per square decimetre and 3·4 to 3·8 volts. The electrolysis is complete in $1\frac{1}{2}$ to 2 hours, and the results are satisfactory. Nickel mattes are dissolved in hydrochloric acid, nitric acid being subsequently added, and the solution evaporated with sulphuric acid until white fumes appear; after removal of copper, arsenic, and antimony in the usual way, the solution is treated as before. In this case, nickel and cobalt are deposited together. T. E.

Volumetric Estimation of Bismuth by Alkaline Arsenite. By C. Reichard (*Zeit. anal. Chem.*, 1898, **38**, 100—101).—The bismuth is converted into bismuthic acid, either by adding an excess of alkali to the solution of a bismuthous salt and passing a current of chlorine, or by adding the bismuthous salt directly to a hot mixture of sodium hypochlorite and hydroxide. After boiling until the precipitate has acquired a deep red colour, it is thoroughly washed by decantation. A known excess of a solution of arsenious anhydride in sodium hydroxide is then added; the more concentrated this solution, the more rapid will be the reduction. The mixture is boiled until the red precipitate has been completely reduced to white bismuthous hydroxide; sulphuric acid is then added until the reaction is strongly acid, and the precipitate is removed by filtering hot. The residual arsenious acid in the filtrate is then titrated by permanganate. It is shown that the results obtained are concordant, but no proof of their correctness is given.

M. J. S.

Detection of Iodoform in Aqueous Solution. By LUDWIG VON STUBENRAUCH (*Chem. Centr.*, 1898, ii, 1285).—See this vol., i, 398.

Action of Carbonic Anhydride on Potassium Ferrocyanide. By GUIDO GIGLI (*Chem. Zeit.*, 1898, **22**, 775—776).—When a cold solution of potassium ferrocyanide is saturated with carbonic anhydride, only a very slight turbidity is produced, but, on boiling, hydrocyanic acid is evolved, and a greenish precipitate, probably $K_2Fe_2(CN)_6$, is formed in small amount. If this is filtered off and the treatment renewed, fresh quantities of hydrocyanic acid and the greenish precipitate are formed. It seems probable that the carbonic anhydride in presence of water forms salts in which a portion of the potassium of the ferrocyanide is replaced by hydrogen, and that when the liquid is boiled these decompose, giving rise to hydrocyanic acid and the greenish-coloured potassium ferrous ferrocyanide. It follows, therefore, that the method proposed by Fresenius for detecting potassium cyanide in potassium ferrocyanide by the formation of hydrocyanic acid when the solution is treated with carbonic anhydride and distilled, is valueless. Sulphurous acid acts similarly to carbonic anhydride, but more energetically. A. H.

Action of Dilute Acids on Potassium Ferrocyanide. By WILHELM AUTENRIETH (*Chem. Zeit.*, 1898, **22**, 866—867).—The author points out that the decomposition of potassium ferrocyanide by carbonic and other weak acids described by Gigli (preceding abstract), has been fully studied by him (*Kurze Anleitung zur Auffindung der Gifte*, 1892, s. 8), and recognised by Fresenius (*Anleitung zur Qualitativen Analyse*, 1895, 306). The only process available for the detection of potassium cyanide in potassium ferrocyanide is that of Jacquemin, in which the sample is distilled with sodium hydrogen carbonate, which liberates hydrocyanic acid from cyanides, but not from ferrocyanides. A. H.

Detection of Methylic Alcohol in Spirits: Presence of this Alcohol in Brandy from Marc. By AUGUSTE TRILLAT (*Compt. rend.*, 1899, **128**, 438—440).—The author has applied his method for the detection of methylic alcohol (this vol., ii, 130) to various spirits. Fifty c.c. of the spirit was mixed with 50 c.c. of water and 8 grams of calcium oxide and fractionated; the first 15 c.c. was diluted to 150 c.c., oxidised by means of 15 grams of potassium dichromate and 70 c.c. of dilute sulphuric acid (1 : 5), and treated in the manner previously described (*loc. cit.*). In the case of liquids like absinthe, 50 c.c. was mixed with 50 c.c. of water and 2 to 3 grams of calcium hydroxide, filtered through animal charcoal, and distilled as above.

Genuine rum, arrack, kirschwasser, absinthe, and cognac were found to be free from methylic alcohol, and this, in the case of rum, confirms the statements of Prinsen Geerligs; low priced samples of the same spirits, however, were found to contain proportions of methylic alcohol representing the addition of from 5 to 15 per cent. of methylated alcohol.

Some samples of brandy from marc were found to be free from methylic alcohol, whilst others contained it, probably as a result of defective distillation. C. H. B.

Colour Reaction for Methylic Alcohol. By S. P. Mulliken and H. Scudder (*Amer. Chem. J.*, 1899, **21**, 266—271).—A piece of light copper wire is wound into a close spiral about 2 cm. in length; it is superficially oxidised in the Bunsen flame and, whilst still red hot, is plunged into 3 c.c. of the liquid placed in a test-tube; a second dip is advisable, and with solutions containing less than 0·1 per cent. of methylic alcohol three or four additional dips are necessary, the tube being cooled after each. A concentrated spirit should always be diluted with at least 3—4 volumes of water before oxidation. The formic aldehyde produced is detected by the aid of a 0·5 per cent. aqueous solution of resorcinol. One drop of the solution is added to the oxidised methylic alcohol and the mixture very cautiously poured down the side of a test-tube containing a few c.c. of concentrated sulphuric acid, the presence of methylic alcohol in the suspected liquid being indicated by the appearance of a pure rose-red zone at the junction of the two liquids. Too large a quantity of resorcinol is to be avoided, as it tends to destroy the purity of the rose colour. Other substances which give similar colorations are secondary and tertiary butylic alcohols, dimethylethylcarbinol, formic acid, and most methylic salts and ethers. The colour with formic acid is extremely feeble. Other monohydric alcohols give ochreous yellow, and polyhydric alcohols give brownish-purple colorations. J. J. S.

Distinctive Reactions for Creosote and Guaiacol. By H. Fonzes-Diacon (*Bull. Soc. Chim.*, 1898, **19**, [iii], 191—192).—The guaiacol present in commercial creosote may be estimated colorimetrically by treating a dilute solution of the specimen under examination with either sodium nitrite and nitric acid or with copper sulphate and potassium cyanide, and matching the coloration produced with that developed by these reagents in guaiacol solutions of known strength. In the absence of the standard solutions, a small quantity of the specimen is treated with 2—3 c.c. of 4 per cent. copper sulphate solution and 1—2 c.c. of potassium cyanide solution of the same strength; coloured striæ at once appear in the solution; these, when viewed by transmitted light, are green when guaiacol is absent; traces of this substance give rise to reddish-grey streaks, whilst larger quantities produce a brownish-purple coloration. G. T. M.

Estimation of the Quality of Sugar Beet. By L. Sempolowski (*Landw. Versuchs-Stat.*, 1899, **51**, 341—349).—Roots from the same seed, and growing on the same land, vary more or less in the amount of sugar they contain (even as much as 6 per cent.), and it is necessary in sampling to obtain at least 50 or 60 roots from a field. The most exact method is to take every 50th or 100th root, or if the number of roots is immaterial, a whole row of roots may be taken from a field, or even two rows at right angles to each other. After cutting off the heads, which must include the whole of the cells containing chlorophyll, small sections are rasped from the whole length of each root (Keil's segment rasper takes out about 9 per cent. of the weight of a root). A normal pulp, which should be very fine, remains unchanged for 12—24 hours.

As regards the employment of lead acetate solution, the ordinary amount is 2 c.c. to the normal weight of pulp; it should be added to the flask with the pulp, which is thus rendered more porous. As much as 4 c.c. of lead acetate may be added without loss of sugar. Water extracts require plenty (5—6 c.c.) of lead acetate solution.

Instead of employing dishes, the recommendation is made that the pulp should be weighed directly in flasks with wide necks.

It has recently been stated that, in the selection of seed by the usual method, sugar beet is obtained which contains a high percentage of raffinose. The amount of raffinose is, however, only slight (at most 0·02 per cent.), and the examination of five samples of roots of high percentage showed no considerable difference between the direct and the inversion method.

As the chemical methods present no difficulties, special attention must be given to obtaining large samples of roots from which thin, representative sections must be properly rasped so as to obtain a fine pulp. N. H. J. M.

Detection of Aloes. By Alois Kremel (*Zeit. anal. Chem.*, 1899, **38**, 193—195; from *Erstes Decennium der Helfenberg. Annalen*, 6).—Solid substances are exhausted with alcohol, alcoholic or aqueous solutions are evaporated on the water-bath, and the residues dissolved in water or alcohol respectively. The latter solution is again evaporated and the residue taken up with water; the aqueous solution being then precipitated with excess of basic lead acetate and the excess of lead removed from the filtrate by sodium sulphate. By these operations, all substances which interfere with the reactions are removed. The special reactions for aloin may then be applied. One of the most characteristic is the conversion into chrysammic and picric acids; the solution is evaporated to dryness and the residue digested for some hours with 6 parts of concentrated nitric acid of sp. gr. 1·45, 3 parts of water are added, and the solution heated on the water-bath. On the further addition of water and cooling, the chrysammic acid separates in deep yellow to orange crystals. Chrysammic acid may be identified by the carmine-red colour of its alkali salts, the violet colour of its ammonium salt, and the insolubility of its barium salt. The picric acid is recognised by dyeing wool yellow. M. J. S.

Evaluation of Secale Cornutum (Ergot of Rye). By Heinrich Beckurts and W. Grothe (*Zeit. anal. Chem.*, 1899, 125—126; from *Zeit. allgem. oesterr., Apoth.-Vereins*, **50**, 31), and by C. C. Keller (*Schweizer Wochensch. Pharm.*, 894, 121).—In estimating the cornutine present, the fatty oil must first be removed; the drug is, therefore, reduced to coarse powder and thoroughly exhausted with light petroleum. After drying, the substance is shaken with 100 grams of ether and 1 gram of magnesia, previously mixed with 20 c.c. of water, and left for three or four hours; 60 grams of the clear, ethereal solution are then removed, and shaken in a separating funnel successively with 25, 15, 10 and 10 c.c. of 0·5 per cent. hydrochloric acid. The acid solution is then supersaturated with ammonia and again shaken with ether; when evaporated, this ethereal solution leaves the cornutine. Various specimens yielded from 0·1 to 0·2 per cent., and as a rule those dried over quicklime gave a larger yield than those kiln-dried at 50°. M. J. S.

Precipitation of Urea by Phosphotungstic Acid. By Allyre Chassevant (*Bull. Soc. Chim.*, 1898, **19**, 255—256).—With solutions containing more than 2 per cent. of urea, phosphotungstic acid produces a precipitate, which, however, dissolves on diluting with water; in using Pflüger's method for precipitating substances other than urea from urine, care must, therefore, be taken that the solutions are sufficiently dilute to prevent any of the latter being thrown down. W. A. D.

Estimation of Alkaloids by means of Standard Iodine Solution. By Max Scholtz (*Arch. Pharm.*, 1899, **237**, 71—80).—This paper describes an experimental examination of Kippenberger's methods (Abstr., 1895, ii, 467; 1896, ii, 282, 682), and concludes with the words: (1) The theoretical considerations upon which Kippenberger's methods are based are in contradiction with elementary chemical laws. (2) Kippenberger's analytical results cannot for the most part be obtained under the conditions employed by him. (3) The methods recommended by Kippenberger for the quantitative estimation of alkaloids by means of standard iodine solution are worthless.

C. F. B.

Estimation of Caffeine in Tea, Coffee, and Kola. By Johannes Gadamer (*Arch. Pharm.*, 1899, **237**, 58—68).—The method of Hilger-Juckenack (*Forschungsber. ü. Lebensmittel*, &c., iv., **49**, 145) gives a lower percentage of caffeine in all cases than that of Keller (Abstr., 1898, ii, 269). This is because the caffeine is not entirely extracted by the boiling water; the author finds that 3 hours boiling does not effect complete extraction. Keller's method is simple, rapid, and gives very good results.

As regards coffee, it has already been shown that Keller's methods, slightly modified, may be used with the raw material (Siedler, *Ber. deut, pharm. Ges.*, 1898, 8, 19). The author now shows that it may be used with the roasted berries; here again the Hilger-Juckenack method gives lower results.

As regards kola, Keller's method gives (as in in the case of tea) the same result whether ammonia be used, or water in its stead. Hence, if the dry material does contain "combined" caffeine, probably in the form of a tannate, the compound is at once decomposed by water. For all practical purposes, then, it is useless to insist on the distinction between "free" and "combined" caffeine; the distinctive effect of kola-nut preparations must be due to the presence of yet other substances. C. F. B.

Modification of the Thalleioquinine Test. By Egidio Polacci (*Chem. Centr.*, 1898, ii, 1221; from *Pharm. Post.*, **31**, 509).—Lead dioxide may be used instead of chlorine water when testing for quinine. One gram (? 0·01 gram) of the substance is put into a test-tube and dissolved in 1 c.c. of water and two drops of dilute sulphuric acid; the blue fluorescence is in itself a proof of the presence of quinine. A small quantity of lead dioxide is added, the mixture well shaken, and after heating thrice to boiling, 4 c.c. of water is added; when the liquid has become clear, a few drops of ammonia are carefully run in when a splendid emerald-green ring is formed if quinine is present.

L. de K.

Estimation of Alkaloids in Cinchona Bark. By Wilhelm Lenz (*Zeit. anal. Chem.*, 1899, **38**, 141—154).—The methods hitherto published are all more or less open to objection. That prescribed by the German Pharmacopœia, and that of Haubensack (Abstr., 1891, 1402), as modified by Keller, both give results varying with the degree of fineness to which the bark is pulverised, in consequence, apparently, of the feeble penetration of the cells by the solvent employed; with the former the results are in all cases too low, whilst with the latter, they are impaired by the impurity of the product. In the methods of Meyer (Abstr., 1883, 388) and Hielbig (*Zeit. anal. Chem.*, 1881, 20), the products are very impure, and there is a risk of the destruction of some of the alkaloids by the very powerful agents (lime and sulphuric acid) employed. With the object of breaking down the cell-walls by a reagent which does not decompose quinine, the author advocates the use of an aqueous solution of chloral hydrate. Ten grams of the powdered bark are macerated for 12 hours with a solution of 20 grams of chloral hydrate in 12·5 grams of water, and are then cohobated for half an hour with 150 c.c. of 61 per cent. alcohol, and 2 grams of 25 per cent. hydrochloric acid. The solution is filtered through glass wool, and the residue well washed with the same acidified alcohol; the filtrate and washings are evaporated to a syrup, which is then triturated with a little water and hydrochloric acid, so as to precipitate the resin in the form of fine flocks. By filtering a known portion of this mixture, the washing of the resin may be dispensed with. The acid filtrate is made alkaline with sodium hydroxide, and immediately shaken with chloroform, of which 100, 50, and 50 c.c. suffice to remove all the alkaloids. The chloroform solution is shaken thrice with 2 per cent. hydrochloric acid (100, 50, and 50 c.c.) and once with 50 c.c. of water, and this acid solution is made alkaline and shaken with ether so long as anything is removed thereby. The treatment with ether, and especially the withdrawal of the ethereal layers, must be done rapidly, lest sparingly soluble alkaloids should be precipitated. The ether is distilled off, and the residue dried at 100°. The estimation of the quinine in the products of the above five processes by conversion into iodo-sulphate according to De Vrij (Abstr., 1876, i, 964) showed that the chloral process gave a result agreeing closely with that of Haubensack-Keller, and higher than any of the others, and the method is independent of the extent to which the bark is pulverised.

M. J. S.

Discrimination of Eucaine and Cocaine. By Gustave Vulpius (*Zeit. anal. Chem.*, 1899, **38**, 197; from *Pharm. Centralhalle*, **37**, 295).—A decigram of the substance is dissolved in 50 c.c. of water of 18—20° in a graduated cylinder and gently mixed with two drops of aqueous ammonia. A pure cocaine salt will remain clear for at least a minute, and even if on vigorous shaking crystals of cocaine separate, the liquid does not lose its transparency. In presence of 2 per cent. of eucaine, a strong, milky turbidity is immediately produced by the ammonia, and only disappears on adding 10 c.c. more water; with 5 per cent. of eucaine, 20 c.c. of water must be added.

M. J. S.

A Delicate Test for Solanine, and the amount Yielded by Potatoes. By Bauer (*Zeit. angw. Chem.*, 1899, 99—100).—The quantity of solanine was estimated by the process devised by Meyer, the potatoes being first boiled in their skins. The crop from 1897 yielded 0·002, and that from 1898, 0·0026 per cent. of the alkaloid.

The following test for the alkaloid exceeds in delicacy the usual test with selenic sulphuric acid. If solanine is heated on the water-bath with a solution of telluric acid in moderately concentrated sulphuric acid, a fine raspberry-red colour is developed, which lasts for two or three hours. Other alkaloids, such as atropine, morphine, and quinine, are not affected.

L. de K.

Egg-albumin and Yolk of Egg. By Karl Dieterich (*Chem. Centr.*, 1898, ii, 1283—1284; from *Pharm. Centr.-H.*, **39**, 789—794. Compare Abstr., 1898, i, 390).—White of egg contains 7—17·5 per cent. of water, and has an iodine absorption number = 110—170, that of the anhydrous albumin being 150—170. In determining the iodine number, the albumin should be completely dissolved by allowing it to remain with water overnight. Ordinary egg-albumin contains less than 1 per cent. of fat, but albumin from which the yolk has been incompletely separated has a higher content. To test for gum, dextrin, gelatin, abnormal treatment, &c., 1 gram of the air-dried substance is dissolved in 50 c.c. of water, and the solution allowed to remain 3 days in a closed vessel with a volume of a standard solution of iodine equal to 20 c.c. of a decinormal solution of sodium thiosulphate. It should then not require more than 11 c.c. or less than 6·5 c.c. of the sodium thiosulphate solution. The amount of water in white of egg is determined by drying at 100°, and the ash should not be more than 6 per cent. Insoluble substances such as fibrin are weighed on tared papers.

To test yolk of egg, the fibrin, albumin, yolk, and egg-oil are each isolated, and the iodine absorption number of each determined. The fibrin, which amounts to about 1 per cent., is separated from the yolk by beating, filtering through cloth, and drying. The soluble albumin is carefully evaporated and dried at 30°. The yolk, freed from fat and separated from the egg-oil by ether, has a very pale colour.

E. W. W.

General and Physical Chemistry.

Atomic Refraction of Metals in Carbonyl Compounds, and the Constitutional Formulæ of these Derivatives. By ANTONIO J. FERREIRA DA SILVA (*Bull. Soc. Chim.*, 1898, **19**, [iii], 441—445. Compare Abstr., 1891, 1322).—In reply to Nasini (Abstr., 1898, ii, 274), the author objects to the interpretation put on his former statements (Abstr., 1897, ii, 406), and shows by reference to this investigator's data that the molecular refraction of organic and metallic carbonyl compounds cannot be an additive property. Assuming that the atomic refraction of the elements combined with carbonyl is normal, the molecular refraction of this radicle varies from 9·13 to 18·39.

G. T. M.

Optical Isomerism. By PAUL WALDEN (*Chem. Centr.*, 1898, ii, 917—918; from *J. Russ. Chem. Soc.*, **30**, 483—545).—A summary of the papers bearing on the subject of optical isomerism, published in the *Berichte* and *Zeit. physikal. Chem.* since 1893, with special reference to methods of preparation and theoretical inferences (compare Abstr., 1893, i, 250; 1895, ii, 65, 149; 1896, i, 205; ii, 553, 633; 1898, i, 176, 178; ii, 149). The new matter here collected is concerned mainly with chlorosuccinic, bromosuccinic, chloromalic, phenylchloracetic, and chloropropionic acids and their derivatives. E. W. W.

Radiations from Uranium and other Substances. By HENRI BECQUEREL (*Compt. rend.*, 1899, **128**, 771—777).—The intensity of the radiations from uranium and its compounds shows no appreciable variation after three years, although during the whole of this time they have been enclosed in a wooden box encased with lead. There was some indication of a slight diminution in the intensity of the radiation during the first two or three months under these conditions, but the evidence was not conclusive, and the intensity remained constant subsequently. Two of the earlier observations with uranium indicated that the rays can be polarised by tourmaline, but subsequent observations with uranium, and also with radium and polonium, have failed to confirm this result. Many experiments showed apparent reflection of the radiations from uranium, radium, and polonium from the surface of many metals, wood, glass, paper, paraffin, and other substances. No appreciable differences were observed between rough and polished surfaces, and no reflection of definite images could be obtained, and the experiments do not distinguish decisively between diffuse reflection and secondary radiation. Possibly both causes operate simultaneously, but whichever it may be, the intensity of the effects observed is not affected by reducing the pressure of the surrounding atmosphere to 20 mm. In some conditions, the photographic effect of the apparently reflected rays is greater than that of the direct radiation, and this result seems to indicate the occurrence of secondary radiation.

Some evidence was obtained of refraction of the rays at vertical edges of sheets of glass, mica, paper, and other substances, but, on the other hand, the radiations were found to pass without deviation through prisms of glass and metals, absorption taking place in proportion to the thickness of the material.

The radiations from various substances are not only unequal in intensity, but are absorbed by different substances in different degrees. The radiations from uranium and radium show practically the same absorption phenomena, although those from radium are the more intense. The rays from polonium pass much less rapidly through paper, mica, calcite, or quartz than the rays from radium. Thin sheets of aluminium are more transparent to rays from polonium than to those from uranium, but with thick sheets (2 mm.) the converse is the case.

The radiations from uranium, radium, polonium, and thorium resemble Röntgen rays much more than ordinary light. Hitherto, however, it has not been found possible to change the intensities of the radiations by physical influences. The radiating substances seem to be analogous to ordinary phosphorescent materials, but to retain relatively a very much greater reserve of energy. C. H. B.

[Zinc Sulphide Actinophotometer.] By CHARLES HENRY (*Compt. rend.*, 1899, **128**, 941—944).—A photochemical paper discussing the advantages of the author's zinc sulphide actinometer for photographic purposes. G. T. M.

Variance of the Voltaic Cell. By WILDER D. BANCROFT (*J. Physical Chem.*, 1898, **2**, 427—440).—In applying the phase rule to voltaic cells, the E.M.F. appears as a variable in addition to the temperature, the pressure, and the concentration of the solutions. The variance of the whole cell $V = \Sigma v$, where Σv is the sum of the variances of the separate elements of the cell. If the temperature and pressure of the cell are uniform for all the elements, then $V = \Sigma(v - 2) + 2$. Thus, for the Clark cell, Zn | $ZnSO_4$aq.,Hg_2SO_4 (solid) | Hg, $V = (0 + 1 + 0) + 2 = 3$, the E.M.F. varying with the temperature, the pressure, and the concentration of the zinc sulphate solution; for the Daniell cell, Zn | $ZnSO_4$aq. | $CuSO_4$aq. | Zn, $V = (0 + 1 + 1 + 0) + 2 = 4$. The effect of concentration on the E.M.F. can be determined from the theorem of Le Chatelier, that on passing a current the concentration will change in such a manner as to oppose a maximum counter E.M.F.; thus when the current flows through a cell in such a direction that zinc passes into a zinc sulphate solution, the E.M.F. will be increased by diluting the zinc sulphate, and *vice versâ.* The E.M.F. will increase with the pressure if the volume of the cell decreases with the passage of the current, as was predicted by Gibbs and verified by Gilbault (*Compt. rend.*, 1891, **113**, 465). The effect of temperature can be deduced in a similar way. T. M. L.

Electromotive Force between Amalgams. By HAMILTON P. CADY (*J. Physical Chem.*, 1898, **2**, 551—564).—The electromotive force between two amalgams of different concentrations is independent of the concentration of the electrolyte and of the solvent used in preparing it; this has been verified with zinc and calcium amalgams, using as the electrolyte solutions of zinc chloride, calcium chloride, or calcium iodide in water, alcohol, or pyridine. The electromotive force is calculated from the formula $E = 0{\cdot}0002.(T/v.)\log_{10}(c_1/c_2)$, where T is the absolute temperature, v is the valency of the metal in the electrolyte, and c_1 and c_2 are the concentrations of the two amalgams. Using this formula, normal results are obtained with zinc, lead, tin, copper, and cadmium amalgams (Meyer, Abstr., 1891, 984), but the alkalis and alkaline earths are found to give much greater values for the E.M.F. than those calculated from the formula. It is shown that the heat of dilution of the amalgam, which is usually assumed to be zero, must be introduced into the formula, which then becomes $E = q + 0{\cdot}0002.(T/v).\log_{10}.(c_1/c_2)$, where q is the electrical equivalent of the heat of dilution. The value of q has been determined for a sodium amalgam, and the corrected formula is found to give results which agree closely with the observed values of the electromotive force.

Similar abnormal results have been obtained by Ramsay (Trans., 1889, **56**, 521) in determining the vapour pressures of mercurial solutions, and these can be explained in the same way as due to the presence of a large heat of dilution. T. M. L.

Electromotive Force between Amalgams. A Correction. By Wilder D. Bancroft (*J. Physical Chem.*, 1899, **3**, 107. Compare Cady, preceding abstract).—The work done in carrying a molecular weight of zinc from one amalgam to another is independent of the size of the molecule; the quantity of electricity required is, however, proportional to the number of atoms in the molecule. The E.M.F. of a concentration battery is therefore inversely proportional to the number of atoms in the molecule and not independent of it, as was stated in the paper referred to; the E.M.F. gives a measure of the complexity of the molecule, provided always that the heat of dilution of the amalgam is zero. T. M. L.

Electromotive Force of Concentration Cells. By Joseph E. Trevor (*J. Physical Chem.*, 1899, **3**, 95—106. Compare preceding abstracts).—A mathematical investigation of the influence of the heat of dilution on the E.M.F. of concentration cells. T. M. L.

Electrometric Determinations of Constitution. By Richard Kieseritzky (*Zeit. physikal. Chem.*, 1899, **28**, 385—423).—The dissociation of a number of compounds of mercury with various nitrogenous organic substances was determined by the measurement of the difference of potential between a mercury electrode and a solution of the compound in a suitable solvent, usually N/10 potassium sulphate; Poggendorff's method with a Lippmann electrometer was used, the current being obtained from an accumulator, the E.M.F. of which was from time to time determined by comparison with that of a Weston cell. The mercury derivatives of the following compounds were investigated: triglycolamic acid, diglycolamic acid, hippuric acid, glycocine, acetamide, propionamide, benzamide, carbamide, salicylamide, oxamide, malonamide, succinamide, succinimide, hydrogen cyanide, alloxan, alloxantin, parabanic acid, uric acid, dibenzamide, phthalimide, cyanuric acid, and nitrous acid. As a general rule, the concentration of the mercury ions is greatest in the carboxy-compounds and is greater for the amido- than for the imido-compounds. This generalisation may be of value in determining the constitution in doubtful cases. The E.M.F. of mercury glycocine agrees with that of mercury acetamide and mercury propionamide, and hence the metal is most probably united to the nitrogen in this compound. In mercury cyanide also, the mercury is combined with nitrogen, so that hydrogen cyanide is an imido-compound and the direct derivatives are the isonitriles. Mercury succinimide is also a true imido-compound, and hence the silver compound, which behaves similarly, has most probably an imido-compound, although by the action of alkylic iodides the unsymmetrical alkyl derivatives of succinimide are obtained; the correctness of the usually accepted constitutional formula of these compounds is therefore doubtful. Nitrous acid also appears to be an imido-compound, so that the nitroparaffins are its direct derivatives and the nitrites the iso-compounds. These views of the constitution of hydrogen cyanide and nitrous acid are not in accord with those of Brühl, based on the refraction and dispersion of the compounds (Abstr., 1895, ii, 250; 1898, ii, 362). Incidentally, the formation of a thick jelly by the addition of various salts to mercury acetamide was noticed, but not investigated. L. M. J.

Law of the Dilution of Electrolytes. By PAUL TH. MULLER (*Compt. rend.*, 1899, **128**, 505—507).—Ostwald's law concerning the influence, δ, of the concentration on the difference between the molecular conductivity of a solution of given strength and that of an infinitely dilute solution, and Kohlrausch's law of the decrease in the mobility of the ions with an increase in concentration (this vol., ii, 201) become identical if it is assumed that the anions and kations exert the same influence on the value of δ. In Kohlrausch's numbers, the quotients $\delta_\nu/\delta_{2\nu}$ have practically the same value, 1·333, and if ν is taken as 2^n, the value of δ (after eliminating n) is $\delta = A\nu^{-(0·41504)}$, where A is a constant. Assuming 52·72 as the value of this constant, the equation reproduces Kohlrausch's results with considerable accuracy. The molecular conductivities μ at 18° of normal salts formed by univalent ions are given by the formula $\mu = \mu_\infty - 52·72\nu^{-(0·41504)}$. In the case of Bredig's results (Abstr., 1894, ii, 226), the value of A, at 25°, is 62·152, and hence it is possible to calculate the conductivity μ_∞ if some values of μ are known for any dilution (higher than 30 litres per gram-molecule) at 18° and 25°. C. H. B.

Conductivity of Mixtures of Electrolytes. By F. BARMWATER (*Zeit. physikal. Chem.*, 1899, **28**, 424—430).—Expressions are deduced for the conductivity of solutions of two or more electrolytes, and the applicability of these expressions is proved by determination of the conductivity in the case of mixtures at various concentrations of sodium and potassium chlorides; sodium chloride and potassium iodide; sodium chloride and potassium nitrate; potassium chloride and nitrate; sodium and potassium chlorides and potassium nitrate; and sodium and potassium chlorides, potassium nitrate and potassium iodide. The expressions are based on the previous deductions of the author (this vol., ii, 274), are simple, and in all cases yield values in good accord with the observations. L. M. J.

Dissociative Power of Solvents. By LOUIS KAHLENBERG and AZARIAH T. LINCOLN (*J. Physical Chem.*, 1899, 3, 12—35).—In order to ascertain the conditions which are necessary for the production of an electrolyte, the authors have determined to what extent ferric chloride, antimonious chloride, bismuth chloride, and mercuric chloride are capable of yielding conducting solutions when dissolved in various organic and inorganic solvents. The hydrocarbons and their halogen substitution products do not give conducting solutions. Alcoholic solutions conduct well comparatively, but less so in the higher members of the series; phenols give solutions which conduct less than the alcohols. Ethers and acid anhydrides yield solutions of very low conductivity, whilst carbon bisulphide does not give conducting solutions. Aldehydes and ketones give conducting solutions, but chloral forms an exception, and gives non-electrolytic solutions. Ethereal salts, and especially the higher homologues, give solutions of very low conductivity; substitution of Cl, CN, or $CH_3 \cdot CO$, tends to increase rather than decrease the conductivity. Oxidised nitrogen compounds, nitriles and cyclic compounds containing nitrogen give conducting solutions, but phenylhydrazine and aromatic amines give non-conducting solutions. Arsenic trichloride gives conducting solutions, but not phosphorus trichloride. A table is given in the paper showing in detail the results obtained with 72 different solvents, and measurements are given of the conductivity of a number of solutions in methylic and ethylic alcohols, acetone, ethylic acetate and acetoacetate, benzaldehyde, and nitrobenzene.

By far the larger number of solvents which give electrolytic solutions have a high dielectric constant, whilst solvents of low dielectric power do not give conducting solutions; Nernst's hypothesis that there is an intimate connection between these two properties is therefore entirely confirmed. Many of the solvents, however, which give conducting solutions have a very low coefficient of association, and are not polymerised to any appreciable extent; Dutoit and Aston's hypothesis (Abstr., 1897, ii, 546) cannot therefore be maintained. Brühl's hypothesis (Abstr., 1895, ii, 163), that conductivity depends on the residual affinity of tetrad oxygen, pentad nitrogen, &c., is contradicted by the want of conductivity of solutions in ether, ethylic carbonate, chloral, the aromatic amines, phenylhydrazine, and phosphorus trichloride; moreover, the substitution of the unsaturated cyanogen group for hydrogen in ethylic acetate does not produce any marked increase in the conducting power of its solutions.

Molecular weight determinations by the cyroscopic method in nitrobenzene solution gave values which decreased with increasing concentration in the case of ferric chloride, antimony chloride, and stannic chloride, whilst increasing values were obtained in the case of arsenic, bismuth, and phosphorus trichlorides; in the former case, the molecular weight in dilute solution is considerably greater than the calculated value, and in the latter case considerably less. T. M. L.

A Remarkable Class of Inorganic Acids and their Electrolytic Behaviour. By WILHELM HITTORF and HEINRICH SALKOWSKI (*Zeit. physikal. Chem.*, 1899, **28**, 546—555).—In the electrolysis of solutions of gold and platinic chlorides in those of other chlorides, the separation of the heavy metal at the cathode is considered to be due to secondary reactions. By the electrolysis of the compounds $PtCl_4,H_2O$ and $AuCl_3,H_2O$, the authors show that the metal is contained in the complex acid ion and the transference ratios for the two compounds are determined; hence the chlorides of gold and platinum are intermediate between the ordinary metallic chlorides and those chlorides which are decomposed by the addition of water. L. M. J.

Some Iodine Compounds. By EUGENE C. SULLIVAN (*Zeit. physikal. Chem.*, 1899, **28**, 523—545).—Diphenyliodonium hydroxide (Hartmann and Meyer, Abstr., 1894, i, 242) is an alkaline compound, and has been stated to be a somewhat weaker base than ammonia; conductivity determinations, however, prove it to be comparable with sodium and potassium hydroxides, as it is very highly dissociated. This is also seen by the determination of its hydrolysing power, the velocity coefficient of the hydrolysis of methylic acetate induced by it being approximately equal to that induced by sodium hydroxide of equal concentration. The atomic refraction of iodine in these bases was determined and found to be somewhat higher than that of univalent iodine in organic compounds, and to be approximately equal to that of iodine ions, whilst in benzene iododichloride a still higher value obtains. This chloride also readily loses chlorine and is a powerful oxidising agent; by the comparison of the E.M.F. of a platinum electrode in a solution of the compound in N/2 hydrogen chloride with that of a similar electrode in a solution of chlorine in the same solvent, its electrical potential was found to be somewhat less than that of the free gas. Similar determinations were made with rubidium iodochloride (Abstr., 1893, ii, 67), and with iodine chloride, both compounds being found to have equal electrical potentials. Cryoscopic and conductivity determinations indicate that the last two compounds in hydrochloric acid solution do not completely decompose, but form complex ions. L. M. J.

Transference Number of Hydrogen. By WILDER D. BANCROFT (*J. Physical Chem.*, 1898, **2**, 496—497).—The determinations of the migration velocity of hydrogen in hydrochloric acid by Bein (Abstr., 1898, ii, 533), Hopfgartner (Abstr., 1898, ii, 151), and McIntosh (this vol., ii, 137), give the values 314, 324, and 333 respectively, taking the migration velocity of chlorine as 63. If, however, the value for hydrogen is calculated from the conductivity at infinite dilution, independently of the migration-velocity of chlorine, the values obtained are 294, 295, and 297, and agree fairly with the value, 290, given by Kohlrausch; the values for chlorine then become 59, 58, and 56, instead of 63. T. M. L.

Dependence of the Transference Ratios of Salts on the Nature of the Dividing Membrane. By WILLY BEIN (*Zeit. physikal. Chem.*, 1899, **28**, 439—452).—A review of the various values for transference ratios of salts obtained by different methods leads to the general conclusion that the relative velocity of the kation is in all cases less when a dividing membrane is used than when no such division is employed. This difference is most marked for animal membranes, and is small or negligible for porous clay divisions or for parchment paper. In order to test the correctness of this conclusion, the transference ratios of hydrogen, sodium, lithium, calcium, and cadmium chlorides were determined with various septa of (1) clay, (2) parchment paper, (3) fish bladder, or (4) gold beaters' skin, and in all cases the velocity of the kation is diminished by use of the two latter membranes. The values obtained by Hittorf and others with membranous septa are collected and compared with those obtained by the author (Abstr., 1898, ii, 553). This influence of the membrane does not appear to depend on its general permeability, and the probable cause is briefly discussed; it may be due to a chemical activity of the membrane, which would hence possess the character of an acid, or to polarisation induced by the current in the membrane. In either case, the result is that membranes actually behave as partial semipermeable divisions. L. M. J.

Thermal Conductivity of Various Kinds of Glass. By ADOLF WINKELMANN (*Ann. Phys. Chem.*, 1899, [ii], **67**, 794—802).—The absolute values of the thermal conductivity of a number of different glasses obtained by Focke (*ibid.*, 132), do not agree with those previously obtained for the same materials by Paalhorn. After reviewing the results, the conclusion is drawn that it is impossible to decide which set is the more correct. The relative values agree fairly, and the differences are probably chiefly due to the different temperatures at which the observers worked, the dependence of the conductivity on temperature being very imperfectly known. The observations also show that two glasses nominally identical may differ considerably in respect of this and other physical constants, and hence, if identical glasses are required, they must be obtained from one melting.

L. M. J.

Pressure Variation of the Latent Heat of Fusion. By GUSTAV TAMMANN (*Ann. Phys. Chem.*, 1899, [ii], **67**, 871—878).—The variations of the latent heat of fusion with temperature at constant pressure, and with pressure at constant temperature, are first deduced, and hence the alteration of the latent heat along the melting point curve. The most important factor is $(c_l - c_p)$, that is the difference between the specific heats in the liquid and solid states at the melting point. This expression is probably always positive, and the accuracy of those experiments of Brunner (Abstr., 1894, ii, 439), for which the converse was found to obtain, is held to be doubtful. L. M. J.

Thermal Properties of Quicklime prepared at Different Temperatures. By HENRI GAUTIER (*Compt. rend.*, 1899, **128**, 939—941).—Four specimens of calcium oxide were prepared from pure calcite by heating the carbonate at 1000°, and at 1200°, in the oxyhydrogen flame, and in the electric furnace. The specimens prepared at the lower temperatures were more readily hydrated than those heated to higher temperatures; the specimen which had been fused in the electric furnace was hydrated with extreme slowness. The heat of dissolution of the four preparations in 5 per cent. hydrochloric acid was determined by Berthelot's calorimetric method, and the purity of the specimen under investigation was gauged by acidimetric estimations of the excess of acid remaining in the calorimeter. These experiments indicate that, whatever be the temperature at which it is produced, the heat of dissolution of calcium oxide in hydrochloric acid is the same, the mean value for 5 per cent. acid being 46·48 Cal. This result accords with the observation made by Berthelot, that the heat of formation of magnesia is the same whether this oxide be prepared at 440° or at a bright red heat. G. T. M.

Heats of Combustion and Formation of Organic Compounds.

By Marcellin P. E. Berthelot and Gustave André (*Compt. rend.*, 1899, 128, 959—971).

Substance.	Heat of combustion.		Heat of formation.	Heat of solution.
	At constant volume.	At constant pressure.		
Cholesterol.........	3836·4 Cal.	3843·0 Cal.	127·9 Cal.	
Glycollonitrile.. ..	257·1	257·0	36·0	−0·11 Cal.
Lactonitrile	421·15	421·3	36·0	0·86
Xanthine...	516·0	512·8	96·7	
Paraphenylenediamine............	843·3	843·9	−2·1	
Nicotine	1426·5	1428·0	liq. −1·9 diss. +5·15	7·05
Pyrroline	567·6	568·1	−18·1	
Carbazole	1474·8	1477·0	−34·9	
Indole...............	1021·8	1022·5	−26·5	
Scatole	1169·7	1170·7	11·5	
α-Methylindole....	1167·9	1168·9	−9·7	
Oxindole............	950·45	950·8	45·1	

C_2H_3NO liq. (glycollonitrile) + H_2O liq. = $C_2H_5NO_2$ cryst. (glycollamine) + 19·1 Cals.
C_2H_3NO liq. + $2H_2O$ liq. = $C_2H_4O_3 \cdot NH_3$ diss. + 16·8 Cal.
C_3H_5NO liq. (lactonitrile) + H_2O liq. = $C_3H_7NO_2$ cryst. (alanine) + 32 Cal.
C_3H_5NO liq. „ + $2H_2O$ liq. = $C_3H_6O_3NH_3$ diss. + 19·1 Cal.

A comparison of the heats of formation of indole, oxindole, and dioxindole indicates that the addition of the first oxygen atom is accompanied by development of heat, which is double that produced by the introduction of the second. The addition of another oxygen atom gives rise to isatic acid; the heat effect has not, however, been directly estimated, owing to the instability of the acid, but when calculated from the equation for isatin, the corresponding lactone, it is found to be 48·6 Cal.; it is therefore greater than that produced by the addition of the second atom. The reaction is, however, more complex, and isatin may really be a polymeride of the substance represented by the formula $C_8H_5NO_2$. G. T. M.

Thermodynamical Expressions for the Heat of Dissolution and of Dissociation of Electrolytes. By ARTHUR A. NOYES (*Zeit. physikal. Chem.*, 1899, **28**, 431—438).—A controversial paper in which the author upholds his objections to the expressions deduced by van Laar (this vol., ii, 11). A new expression is also deduced for the heat of dissociation of any electrolyte, namely, $Q = RT^2.(n-1)/(a-1).d \log k/dT$ where a is a constant introduced by the empirical dilution law, $x^a/(1-x)v^{a-1} = k$, obeyed by the electrolyte.

L. M. J.

Heat of Solution of Liquid Hydriodic Acid. By F. G. COTTRELL (*J. Physical Chem.*, 1898, **2**, 492—495).—Hydrogen iodide was prepared free from iodine by distilling from a spiral of copper wire in a closed tube, one end of which was cooled by means of solid carbonic anhydride. The heat of solution of the liquefied hydrogen iodide in water was found to be 148 Cal., and if the heat of solution of gaseous hydrogen iodide is subtracted, the latent heat of vaporisation is found to be 43 Cal.; the heat of formation of gaseous hydrogen iodide is -60 Cal., and that of the liquid is therefore -17 Cal.

T. M. L.

Solubility and Melting Point as Criteria for Racemic Compounds, Pseudoracemic Mixtures, and Inactive Conglomerates. By HENDRIK W. BAKHUIS ROOZEBOOM (*Zeit. physikal. Chem.*, 1899, **28**, 494—517. Compare this vol., ii, 276).—If the solubility of the two components be represented by two rectangular coordinates, then the solubility of mixtures which form an inactive conglomerate is represented by two curves *ac*, *bc*, meeting in *c*, which, owing to the equal solubility of the components represents an inactive solution. Below the transition point, however, the form of the curve will be different owing to the formation of a racemic compound, and consists of three curves, those of the racemic compound and of each component, whilst at the two points of section, two solid phases occur, namely, racemic compound and one component. These points approach and ultimately coincide at the transition temperature. Hence, if evaporation go on above this temperature, one of the components first separates and ultimately the inactive mixture, and this was found to be the case by Kipping and Pope (Trans., 1899, **73**, 39). If, however, the racemate is stable at the temperature of evaporation, although at first either component may separate, yet the final product is a mixture of racemic compound with one component, and hence it is considered that in Kipping and Pope's experiments with potassium sodium racemate (*loc. cit.*), which do not substantiate this conclusion, the double tartrate had been formed. In the case of a partially racemic mixture, a similar result obtains, but the curves are displaced towards one or other of the axes. In a pseudoracemic mixture, the solubility curve for mixed crystals must obtain; that is, above the transition temperature the curves *ac*, *cb* become one continuous curve, whilst below the case is similar to that of the racemic compound, but the two curves for the double solid phase become continuous. The various types of melting point curves are also considered; for a racemic compound, this must consist of three curves with two minima, and a maximum for the inactive mixture, which, however, may be higher or lower than that of the components. For a conglomerate, the curve consists of only two parts with one minimum, and for a pseudoracemic mixture it is continuous. The melting point of a racemic compound is thus lowered by the addition of either component, that of an inactive conglomerate is raised. The author then considers the various cases which may occur owing to changes between the three types of compounds during fusion, and illustrates the cases by the possible melting point curves. L. M. J.

Isothermal Pressure-Surface for Two Single Salts and One Double Salt. By FREDERICK GEORGE DONNAN (*J. Physical Chem.*, 1898, 2, 417—420).—The nature of the vapour-pressure surface for aqueous solutions of two salts, *A* and *B*, which form a single double salt, *AB*, is described. The boundary is formed by three lines, which give the vapour-pressure of the solution when saturated with regard to *A*, *AB*, and *B* respectively; on isothermal evaporation, the proportions of *A* and *B* remain unchanged until this boundary curve is reached and solid begins to separate. The composition of the solution then changes in such a way that the vapour-pressure decreases until it reaches a minimum, after which the solution remains constant in composition; such a minimum may occur at the stable quadruple points at which the solution is saturated with regard to *A* and *AB*, or *B* and *AB*, but cannot occur at any other point. A maximum may, however, occur on the part of the curve which represents the vapour pressure of solutions which are saturated with regard to *AB*; this point must be such that the constituents *A* and *B* are present in the solution in the ratio in which they combine to form *AB*, and in this case the double salt alone crystallises in a pure state from solution.
T. M. L.

Pressure-temperature Diagrams for Binary Systems. By WILDER D. BANCROFT (*J. Physical Chem.*, 1899, 3, 1—11).—The pressure-temperature diagram for a binary system has been given by van't Hoff (*Vorlesungen über theoretische Chemie*, 35) on the assumption that the partial pressure of one of the components is negligible. The present paper contains a discussion of the various cases that are possible when neither of the partial pressures is negligible. T. M. L.

Boiling Point Curves. By E. F. THAYER (*J. Physical Chem.*, 1899, 3, 36—40. Compare this vol., ii, 140).—The boiling points have been determined of mixtures of alcohol and acetone, of acetone and chloroform, and of chloroform and alcohol. Mixtures of alcohol and acetone all have a boiling point intermediate between those of the separate substances. The boiling point curve for alcohol and chloroform exhibits a minimum, and a mixture containing about 7 per cent. of alcohol distils unchanged at 58·5° under 732·5 mm. pressure. The boiling point curve for chloroform and acetone exhibits a maximum, and a mixture containing about 19 per cent. of acetone distils unchanged at 63—64° under 737·1 mm. pressure. T. M. L.

Reversible Reactions. By JOHN WADDELL (*J. Physical Chem.*, 1899, 3, 41—45).—In a monomolecular reaction, the form of the differential equation which represents the velocity of change is the same whether the action is complete or incomplete. Walker and Hambly (Trans., 1895, **67**, 753) have assumed that it is also the case in a bimolecular reaction; this is not strictly true, and the author deduces a formula for the velocity constant in a reversible bimolecular reaction which differs in form from that which holds in a non-reversible bimolecular reaction; in the former case, $\frac{1}{t}\log\frac{x(1-\sqrt{a})-A}{x(1+\sqrt{a})-A}$ is constant, where A is the original mass of the substance, x the mass at time t, and a is the equilibrium constant; in the latter case $a=1$, and the constant is $1/t \log A/A-x$. T. M. L.

Vapour Pressure of Dilute Aqueous Solutions at 0°. By Konrad Dieterici (*Ann. Phys. Chem.*, 1899, [ii], **67**, 859—870).—The author's determinations of the vapour pressure of solutions having been criticised by Abegg (Abstr., 1898, ii, **207**, 368), he has redetermined the difference between the vapour pressure of water and that of solutions of sulphuric acid, sodium chloride, cane sugar, glycerol, or carbamide at 0°, and at concentrations varying from N/1 to N/10. The accuracy of the results is discussed, and it is held that when the probable errors are allowed for, the following results are still indicated. For sulphuric acid solutions, the molecular depression of the vapour pressure does not increase with dilution between the above concentrations. In the same concentration interval, the molecular depression of sodium chloride is constant, and the determinations in both these cases are in good accord with Raoult's observations. The molecular depressions of the non-electrolytes are not equal, being greatest for dextrose and least for carbamide, results again in accord with those of Raoult and of Loomis. L. M. J.

Freezing Point in Ternary Mixtures. By John Waddell (*J. Physical Chem.*, 1899, **3**, 160—164. Compare McIntosh, Abstr., 1898, ii, 65).—The lowering of the freezing point of water by addition of acetone agrees well with that calculated for a molecular depression of 18·5. The addition of a third substance, slightly miscible with water and readily miscible with acetone, might be expected in some cases to lower the freezing point until a certain quantity had been added, and then cause a rise in the freezing point. The addition of salicylic acid, phenol, paranitrophenol, or quinol was found to give a steady rise in the freezing point; in the last case, however, the addition of 0·755 gram to a solution of 9·71 grams of acetone in 100 grams of water caused no rise in the freezing point, and it is possible that a smaller quantity of quinol might have caused an initial depression. Ether causes a steady depression of the freezing point, and no subsequent rise could be observed. T. M. L.

Internal Friction of Gases and its Alteration with Temperature. By Paul Breitenbach (*Ann. Phys. Chem.*, 1899, [ii], **67**, 803—827).—Determinations of the internal friction of air, ethylene, hydrogen, carbonic anhydride, and methylic chloride were made, by the transpiration method, at a series of temperatures varying between −20 and 300°. The viscosity is proportional to the absolute temperature raised to a fractional power, that is $\eta \propto T^x$; the value of x differs, however, for different gases, varying between 0·6 and 1·0 for the five gases examined, but remains *approximately* constant for each gas through the whole range of temperature, although the change is always a decrease for the higher temperatures. For mixtures of gases, an additive law is not obeyed, the viscosity of a mixture of carbonic anhydride and hydrogen being greater, and that of ethylene and air less, than that calculated from the percentage composition. Experiments were also made to determine the sliding of the air over the glass surface, an effect which, in Schumann's opinion, rendered the transpiration method inaccurate at high temperatures. This was, however, found to be extremely slight, and to vary but slightly with temperature, so that Schumann's objection does not hold. L. M. J.

Mixtures of Gases and their Compressibility. By DANIEL BERTHELOT and PAUL SACERDOTE (*Compt. rend.*, 1899, **128**, 820—822).—The authors have determined the value of A in the expression $P_1V_1/P_2V_2 - 1 = A(P_2 - P_1)$ at 16° and between 1 and 2 atmospheres for certain mixtures of gases, with the following results:

	Value of A.
Carbonic anhydride, 505 vols., and sulphurous anhydride, 495 vols.	143×10^{-6}
Air	5×10^{-6}
Hydrogen and oxygen, equal volumes	-2×10^{-6}

In the cases of carbonic anhydride and sulphurous anhydride and of oxygen and hydrogen, the observed value is distinctly lower than that calculated; in the case of air, the difference between the two values is not greater than the error of experiment. The mixture by diffusion of equal volumes of oxygen and hydrogen is accompanied by an increase of pressure of 0·20 mm. C. H. B.

Kinetic Theory of Liquids. By GUSTAV JÄGER (*Ann. Phys. Chem.*, 1899, **67**, 894—898).—A reply to some criticisms of Voigt and Dieterici on the author's many deductions, based on the application of the kinetic theory to liquids, which have appeared in numerous papers in the *Wiener Sitzungsberichte* from 1890. L. M. J.

An Equation Representing the Molecular Weight of Liquids in Terms of their Densities and Critical Constants. By DANIEL BERTHELOT (*Compt. rend.*, 1899, **128**, 606—609).—Young proved experimentally that, for any fluid at the critical temperature, there is a constant ratio between the critical volume and the theoretical volume calculated from the law of perfect gases. The constant being taken as 1/3·6, the relationship between the molecular weight and the critical constants is represented by the equation $M = 22{\cdot}4.T_cd_c/3{\cdot}6 \times 273.p_c$. Mathias showed that, providing the temperature is sufficiently remote from the critical, the following relationship is approximately true: $d_c = d/2(2 - T/T_c)$, where d is the density of a liquid at the absolute temperature T.

On eliminating d_c from these equations, a third expression, $M = 11{\cdot}4.T_cd/p_c(2 - T/T_c)$, is obtained, by means of which the value of the molecular weight in the liquid state may be calculated. A table is given comparing the values obtained from the equation with those deduced from the chemical formulæ; it indicates that, in the great majority of cases, the substance, whether elementary or compound, has the same molecular complexity in the liquid as in the gaseous state. Water and the aliphatic acids and alcohols alone show signs of polymerisation. G. T. M.

Influence of an Electrolyte of Two Ions on the Solubility of an Electrolyte of Three Ions. By Arthur A. Noyes and Edward S. Chapin (*Zeit. physikal. Chem.*, 1899, **28**, 518—522).—The expressions for indicating the influence of an electrolyte of two ions on the solubility of an electrolyte of three ions are deduced and simplified for the case where one of the compounds is but slightly soluble and one of the products but slightly dissociated. The solubility of calcium hydroxide in solutions of ammonium chloride was found to give results in accord with the calculated expressions (compare this vol., ii, 9, 274). L. M. J.

Determination of Solubility at different Temperatures. By Bronislaw Pawlewski (*Ber.*, 1899, **32**, 1040—1041).—In preparing a saturated solution, air is drawn through the liquid by a glass tube bound round at the bottom with linen; when the solution is saturated, the direction of the air current is reversed and the solution driven back through the tube into a weighed vessel. By immersing the whole apparatus in a beaker full of water, the solubility can be determined at any temperature. A sketch of the apparatus is given in the paper, and also a table showing the solubility of potassium chlorate in water for every 5 degrees from 0° to 100°. T. M. L.

Solid Solutions. By Hamilton P. Cady (*J. Physical Chem.*, 1899, **3**, 127—136).—Naphthalene and monochloracetic acid form one series of liquid, but two of solid, solutions. The freezing points of liquid mixtures, in varying proportions, have been determined, and plotted as a curve, the eutectic point being 53° for a liquid mixture of 28·7 parts of naphthalene and 71·3 parts of the acid. The solubility of naphthalene in the solid acid is limited to 2·5 parts in 100 of the mixture, and that of the acid in solid naphthalene to 57 parts in 100 parts of the mixture; mixtures of intermediate composition deposit two kinds of crystals on cooling after fusion. Glycollic acid also forms two series of solid solutions with naphthalene, and dissolves in it to a larger extent than chloracetic acid; acetic acid, and probably also malonic and succinic acids, do not form solid solutions with naphthalene. The depression of the freezing point in cases where a solid solution separates cannot be calculated from the van't Hoff-Raoult formula, and usually n/N is less than log p/p_1 for the solid solution. The author regards the discrepancy as due to thermal effects, such as the presence of a noticeable heat of dilution in the solid solution.

T. M. L.

Solution Densities. By H. T. Barnes and A. P. Scott (*J. Physical Chem.*, 1898, **2**, 536—550).—The authors have determined the densities at different concentrations of solutions of sulphuric acid and zinc, magnesium, cadmium, potassium, and sodium sulphates, hydrochloric acid, and sodium and potassium chlorides, and magnesium, zinc, potassium, and sodium nitrates. The results are given in tables, and are also plotted in the form of curves which show the relationship between the concentration of the solution and the difference between the observed density and that calculated on the assumption that no increase of volume occurs on adding the salt to the water. The relatively abrupt break in the curve, observed in the case of zinc sulphate (Callendar and Barnes, Abstr., 1898, ii, 276), appears in a less marked degree in the curves for magnesium sulphate and cadmium sulphate, but is not noticeable in the other cases investigated.

T. M. L.

Demonstration of the Phase Rule. By PAUL SAUREL (*J. Physical Chem.*, 1899, 3, 69—71, and 137—143).—Two mathematical papers, unsuitable for abstracting. T. M. L.

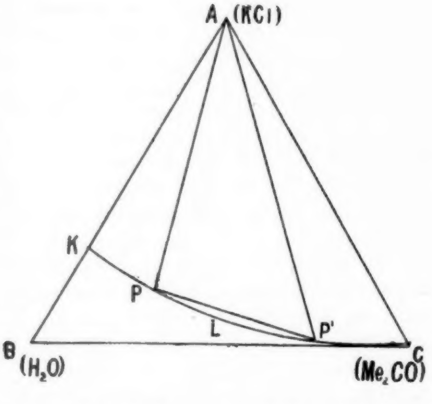
Equilibrium in Systems of Two and Three Components with a Liquid Phase. By GIUSEPPE BRUNI (*Gazzetta*, 1898, 28, ii, 508—529).—The author has compared the saturation phenomena of the different cases of binary mixtures with the corresponding equilibrium phenomena of ternary mixtures, confining himself to systems with only one liquid phase. The ternary mixtures were obtained by adding to the binary mixture, in the form of a solvent, a third substance, which does not combine, and is not isomorphous, with the primitive components; to the cryohydric solution (containing undissolved crystals) of each component in this solvent were added increasing quantities of the other component until the solution became saturated with both, the temperature corresponding with the double cryohydric point being then read off. There are four cases: 1. The components of the binary mixture do not form an additive compound and are not isomorphous. An example is found in mixtures of naphthalene and diphenylamine, which were studied by Roloff (Abstr., 1895, ii, 438). The corresponding ternary system, benzene, naphthalene, and diphenylamine, was examined by the author. 2. The two components form an additive compound (stable) which separates without decomposition at the freezing point. Picric acid and β-naphthol, investigated by Kuriloff (Abstr., 1897, ii, 397), come under this head. For the ternary system, the author used ethylenic bromide as solvent. 3. The two components form an additive compound (unstable) which decomposes on separating from solution. No example of this class was investigated. 4. The two components are isomorphous. The systems (*a*) benzene, naphthalene, β-naphthol, and (*b*) benzene, phenanthrene, carbazole, corresponding with the binary systems examined by Küster (Abstr., 1895, ii, 439) and Garelli (Abstr., 1895, ii, 206) respectively were studied; in both of these cases, it was noticed that, the solidifying point of the solution was raised on adding increasing quantities of the less soluble component (β-naphthol or carbazole) to the cryohydric solution of the more soluble component (naphthalene and phenanthrene respectively). This behaviour is strictly analogous to that of the two binary mixtures.

The results show that if to a system of two components with one, and only one, possible liquid phase there be added a third component which does not combine with the first two and is not isomorphous with them, the curves expressing equilibrium of the same order (saturation curve in the binary system and cryohydric curve in the ternary system) are similar, the only difference being that, in systems represented by curves of ternary mixtures, there is one more solid phase. T. H. P.

Physical Equilibrium of Isomorphous Mixtures. By GIUSEPPE BRUNI (*Gazzetta*, 1899, **29**, i, 149—151).—The author brings forward evidence in addition to that already adduced by him to show the general inapplicability of Küster's second law regarding the physical equilibrium of isomorphous mixtures, namely, that for mixtures of substances perfectly isomorphous the solid phase separating during the freezing has the same composition as the liquid. This law only holds in one particular case, that is, when the freezing point curve for a given pressure runs parallel to the axis of concentrations, or when the two components of the mixture have the same freezing point.

T. H. P.

Potassium Chloride in Aqueous Acetone. By J. F. SNELL (*J. Physical Chem.*, 1898, **2**, 457—491).—The author discusses the nature of the equilibrium in the system potassium chloride—water—acetone, which is capable under certain conditions of giving two liquid phases. At temperatures at which separation occurs, the triangular isothermal diagram for the system will in general have the form shown in the figure. Here $A = \text{KCl}$, $B =$ water, $C =$ acetone; the curve *KPP′C* shows the solubility of potassium chloride in mixtures of acetone and water, the solubility in pure water being shown at *K* and the solubility in acetone being very slight; two liquid phases occur in mixtures in which the components are present in proportions represented by points lying within *APLP′A*. Thus *BKLCB* represents one liquid phase in equilibrium with vapour, *PLP′P* represents two liquid phases in equilibrium with vapour, *APP′A* represents two liquid phases in equilibrium with solid and vapour, *AKPA* and *ACP′A* represent each a liquid phase (consisting chiefly of water and acetone respectively) in equilibrium with solid and vapour. For all points within *APP′A* the composition of the two liquid phases will be represented by *P* and *P′*, but for points within *PLP′P* by two *conjugate points* on *PLP′*, which become identical and vanish at the point *L*. If an axis of temperature be introduced perpendicularly to the paper, the line *PLP′* will become the trace of a surface, to which the name of '*dineric surface*' is applied, the area *PLP′P* becomes the



trace of the '*dineric space*,' and the area $APP'A$ the trace of the '*stereo-dineric space*.' In systems of the type studied in this paper, only one liquid phase is possible at lower temperatures, and with decreasing temperature the points PLP' approach each other until they become coincident and vanish at a point σ, the '*plait point*' of the surface. Thus the dineric surface appears as an excrescence on the solubility surface (of which KC is the trace), which becomes more pronounced as the temperature rises, the points PP' of the boundary curve becoming more divergent, and the '*crest-curve*,' of which L is the trace, becoming more elevated. If the miscibility of the two liquid components decreases with falling temperature, a second dineric surface may appear, the plait point in this case representing a maximum, and not a minimum, temperature for the formation of two layers; such a maximum has been observed in the case of sodium chloride, water, and succinonitrile, but the upper dineric curve did not appear even when the temperature was raised to the point of decomposition, (Schreinemakers, Abstr., 1897, ii, 483).

In the system acetone—water—potassium chloride, the plait point σ lies in the isothermal plane of 32·5° and corresponds with the composition $H_2O : COMe_2 : KCl = 43 : 50 : 7$. The isotherm of 30° is therefore found to give a continuous solubility curve KC. In the isotherm of 40°, the solubility curve is intersected by the dineric curve at P and P', corresponding with $H_2O : COMe_2 : KCl = 59·0 : 25·2 : 15·8$ and $23·7 : 74·9 : 1·4$; this is the isotherm represented in the figure. The isotherm of 50° has also been plotted.

For systems of the type salt—water—organic liquid, it is usually found that the dineric surface overhangs the boundary line, P and P', so that within certain limits an unsaturated solution is found to separate into two layers on raising the temperature. The minimum temperature at which separation occurs has been determined for about 50 solutions, and gives a corresponding number of points on the dineric surface; the temperatures of separation of saturated mixtures of water and acetone in different proportions have also been determined and plotted in the form of a curve, which thus forms a projection of the boundary curve of the dineric surface, the minimum point being the projection of the plait point of the system. Theoretically, the line of constant composition should cut the dineric surface again on a higher temperature, and the two liquid phases should again become one, but actually this has not been observed in the case under consideration; in a mixture of water (66·4 parts), alcohol (16·8 parts), and potassium carbonate (16·8 parts), however, the two liquid phases which appear at 40° disappear again at 70°, as required by the theory. In the system naphthalene—acetone—water, Cady (this vol., ii, 82) found that it was not possible to obtain an unsaturated solution which would separate into two layers on heating; in this case therefore the dineric surface does not overhang the boundary curve. T. M. L.

Alcohol Water and Potassium Nitrate. By NORMAN DODGE and L. C. GRATTON (*J. Physical Chem.*, 1898, **2**, 498—501. Compare preceding abstract).—The temperatures have been determined at which mixtures of alcohol and water in different proportions will separate into two layers in presence of an excess of potassium nitrate. The minimum temperature at which separation will take place is 80° in a mixture containing about 39 per cent. by weight of alcohol. The addition of a second salt facilitates the formation of two layers; thus separation occurs in a 35 per cent. solution at 80° in presence of an excess of potassium nitrate, but at 65° in presence of potassium nitrate and chloride, although potassium chloride alone does not cause any separation even at 140°. T. M. L.

Absorption of Water Vapour by Compounds and its Partition between two Similar and two Dissimilar Substances. By W. J. Busnikoff (*Chem. Centr.*, 1898, ii, 745—746; from *J. Russ. Chem. Soc.*, **30**, 418—429. Compare this vol., ii, 360). —Sodium chloride, placed in a desiccator containing water, had in 55—61·9 days absorbed enough water to dissolve it, forming a hydrate of a composition between that of $NaCl + 8{\cdot}61H_2O$ and $NaCl + 9{\cdot}85H_2O$; when this solution was placed over sulphuric acid, crystals began to separate as soon as its composition became $NaCl + 9{\cdot}16H_2O$, and a solution containing $NaCl + 9{\cdot}495H_2O$ deposited crystals immediately it was placed over the acid, hence the critical hydrate is $NaCl + 9{\cdot}5H_2O$. When a solution, $NaCl + 19H_2O$, containing 1·8564 grams of the chloride, and 8·6004 grams of 93·82 per cent. sulphuric acid were placed under the same vessel, the former had lost all its water after 29·1 days, whilst the composition of the latter was $H_2SO_4 + 4H_2O$. The curve of the velocity of absorption of water vapour by sodium chloride shows the same regularity as those for sulphuric acid and calcium chloride.

The critical hydrate of barium chloride is $BaCl_2 + 3H_2O$, and the absorption curve is almost a straight line deviating a little towards the abscissæ axis. When a solution of the composition, $BaCl_2 + 31{\cdot}86H_2O$, containing 4·0080 grams of water was placed under the same vessel with 3·3293 grams of $H_2SO_4 + H_2O$, the solutions had, in 36 days, become $BaCl_2 + 2{\cdot}08H_2O$ and $H_2SO_4 + 5{\cdot}031H_2O$ respectively, hence the affinities of the hydrates $BaCl_2 + 2H_2O$ and $H_2SO_4 + 5H_2O$ for water are the same. When this solution of barium chloride was again placed with 7·057 grams of sulphuric acid containing 6·6449 of H_2SO_4, equilibrium was attained in 58·9 days, and the solutions had the composition $BaCl_2 + 0{\cdot}958H_2O$ and $H_2SO_4 + 1{\cdot}026H_2O$ respectively. Experiments showed that the hydrate $BaCl_2 + H_2O$ is not as hygroscopic as $H_2SO_4 + H_2O$.

A solution containing 2·1848 grams of magnesium chloride in 1·8818 of water ($MgCl_2 + 4{\cdot}56H_2O$), after remaining over water for 166 days, had attained the composition $MgCl_2 + 17{\cdot}37H_2O$, and the absorption curve up to $MgCl_2 + 9{\cdot}33H_2O$ is nearly straight. This solution of magnesium chloride, when placed in the same vessel with 14·1988 grams of a solution of sulphuric acid containing 13·1988 of $H_2SO_4 + H_2O$, changed to an ice-like mass when its composition was $MgCl_2 + 7{\cdot}13H_2O$, and then gradually formed a white solid; in 34·9 days, the solutions had the composition $MgCl_2 + 6{\cdot}944H_2O$ and $H_2SO_4 + 2{\cdot}185H_2O$ respectively, and finally, after renewing the sulphuric acid, equilibrium between the hydrates $MgCl_2 + 3 \cdot 5H_2O$ and $H_2SO_4 + H_2O$ was established. E. W. W.

Reciprocal Salt Pairs. II. Equilibrium Phenomena in the Presence of a Double Salt. By **Wilhelm Meyerhoffer** and **A. P. Saunders** (*Zeit. physikal. Chem.*, 1899, **28**, 453—493. Compare Abstr., 1896, ii, 414).—The reciprocal salt pair sodium sulphate | potassium chloride is investigated; for this pair, at 3·7° a transition occurs with formation of the double salt $K_3Na(SO_4)_2$ and sodium chloride, whilst, further, at 32·4° there occurs the change from hydrated to anhydrous sodium sulphate. Representing the hydrated sodium sulphate by G, and the double salt by D, the author finds that below 4·4° the triad phases (1) G, $NaCl + KCl$, and (2) G, $KCl + D$ are stable, and above this temperature (3) D, $NaCl + KCl$ and (4) D, $NaCl + G$, and it is noteworthy that in none of these does K_2SO_4 occur. Below $-14°$, however, the triad G, KCl, K_2SO_4 occurs as a solid phase changing at this temperature to either (2) or (5) K_2SO_4, KCl, D, the former being one of the triad phases of the 4·4° transition group. The possibility of $K_2SO_4, NaCl$ coexisting occurs if the saturation curves of (3) and (5) cut. Further investigations at higher temperatures were therefore undertaken, and the apparatus used is described and includes a new form of pipette for the determination of the density of saturated solutions. For the determination of the compounds present in the solid phases, the authors indicate a method which consists in the application of certain characteristic inequalities to the results of the analysis. Thus, for the group (3) the characteristics are $Na_2 > SO_4 \mid 4$ and $K_2 > 3SO_4 \mid 4$, &c. The complete solubility diagrams are given for the isotherms of 0°, 4·4° 16·3°, and 25°. From these, it is evident that the second transition point at which sodium chloride and potassium sulphate coexist is at any rate far above 25°. The observations of Mazotto (Abstr., 1891, 388) and of Precht and Wittgen (Abstr., 1882, 1264) on the solubility of mixtures of sulphates and chlorides of potassium and sodium are also examined and are shown to be, for the most part, in accord with the authors' experiments.

L. M. J.

The Conversion of Ammonium Thiocyanate into Thiourea [Thiocarbamide] and of Thiourea into Thiocyanate. By **John Waddell** (*J. Physical Chem.*, 1898, **2**, 525—535).—The conversion of ammonium thiocyanate into thiocarbamide, and *vice versâ*, is a monomolecular reaction, similar to the case of the two hexachloroketocyclopentenes studied by Küster (Abstr., 1896, ii, 158). Solid ammonium thiocyanate was not changed when heated at 93° for 8 hours a day during 8 months, and only a small quantity of thiocarbamide was produced by boiling the aqueous solution at 109° during 50 hours. The thiocarbamide was estimated by titration with ammoniacal silver nitrate, which gives silver sulphide and cyanamide, and the ammonium thiocyanate by titration with silver nitrate. Equilibrium is reached at 152° when the thiocarbamide and ammonium thiocyanate are present in the ratio of 21·2 to 78·8. The velocity constant, which represents the total weight of substance which would undergo isomeric change on heating one gram of each isomeride during one minute, was found to be 0·00649 and 0·00645 in the conversion of ammonium thiocyanate into thiocarbamide, and 0·00622 in the conversion of thiocarbamide into thiocyanate at 152—153°; the constants should of course be the same, but the agreement noticed here is only rarely observed, owing to the presence of disturbing secondary actions. At 160—161°, the constant was 0·0145 for the conversion of thiocyanate into thiocarbamide, and 0·0123 for the conversion of thiocarbamide into thiocyanate, the velocity of change being doubled by a rise of 8° in the temperature. T. M. L.

Dissociation Studies. I. By WILDER D. BANCROFT (*J. Physical Chem.*, 1899, **3**, 72—94).—A discussion of the equilibrium between a dissociating substance and two products of dissociation on the basis of Duhem's theory of permanent changes (Abstr., 1897, ii, 439), similar to that recently given for the equilibria between two dynamic isomerides (this vol., ii, 145). The theory is applied to the cases of phthalic and succinic acids (formation of anhydride), chloral hydrate and alcoholates, and aldehyde ammonia, which have been examined experimentally by Ramsay and Young (*Phil. Trans.*, 1886, **177**, i, 82). T. M. L.

Benzaldoxime. By FRANK K. CAMERON (*J. Physical Chem.*, 1898, **2**, 409—416).—Bancroft's theoretical conclusions on the equilibria of stereoisomerides (this vol., ii, 145) are applied to the melting point phenomena of benzaldoxime, and it is shown that the double melting point curve can be realised experimentally. The stable α-form melts at 34—35°, and the labile β-form at 130°; the stable triple point at which the solid α-modification is in equilibrium with the liquid mixture and with the vapour phase, Duhem's 'natural melting point,' is 27·7°, and the eutectic point is 25—26°. The equilibrium between the α- and β-forms is independent of the temperature, and is reached when there is about 6 per cent. of the β-form in the liquid mixture; at the eutectic point, the liquid mixture contains 9 per cent. of the β-form. By repeated fusion, the melting point of the β-form fell from 130° to 114°, 98°, 76°, and finally to 26°, corresponding with a gradual change in the composition of the mixture. The freezing points of mixtures of the α- and β-forms in various proportions were determined and plotted in the form of a curve, which consisted of two intersecting straight lines, equally inclined to the vertical; the molecular depression of the freezing point is therefore the same for both isomerides. The molecular heats of fusion are calculated to be 14·3 for the β-, and 8·3 for the α-form. T. M. L.

Equilibria of Stereoisomerides. III. By WILDER D. BANCROFT (*J. Physical Chem.*, 1899, **3**, 144—155. Compare this vol., ii, 145).—The effects are discussed of adding to a mixture of two dynamic isomerides a third substance which forms a compound with one or both of the isodynamic forms. The theory is applied to the formation of two hydrochlorides and two sodium salts from α- and β-benzaldoxime and from some of its substitution products, a reversal of stability occurring in the formation of the hydrochlorides. The equilibrium between fumaric and maleic acids in presence of ammonia and between chloral and metachloral in presence of water are also given as examples of the application of the theory. T. M. L.

Distance of Action of Molecular Forces. By WILHELM MÜLLER-ERZBACH (*Ann. Phys. Chem.*, 1899, [ii], **67**, 899—890).—Determinations have been made of the thickness of layers of gum required to protect wax or sealing-wax from the action of carbon bisulphide; the values obtained are about 0·1 mm., but are different for the two substances. L. M. J.

Explosion of Acetylene when mixed with Inert Gases. By MARCELLIN P. E. BERTHELOT and PAUL VIEILLE (*Compt. rend.*, 1899, **128**, 777—787).—The authors have made experiments on the explosibility of mixtures of acetylene with various proportions of hydrogen or coal gas, with a view to ascertain the limits of pressure below which the decomposition is not propagated throughout the mass of the gas. The results are given in tabular form, and as a rule there is considerable difference between the observed and calculated pressures, the differences being due either to the slow rate at which decomposition takes place, or to the fact that it is incomplete.

The pressure at which propagation of the decomposition under the influence of an incandescent wire ceases to take place is higher the smaller the proportion of acetylene, but rapidly approximates to the limit for pure acetylene as the proportion of this gas is increased. It was not found possible to determine for each mixture an exact critical pressure below which explosion will not take place, but the experiments show that there is in each case a certain range of pressure within which the probability of the propagation of explosion varies very rapidly, but below which the probability is extremely small.

With mixtures of equal volumes of acetylene and hydrogen, the limiting pressure is about 4 kilos. per square cm.; with 2 volumes of hydrogen and 1 of acetylene, it is about 7 kilos., and with 3 volumes of hydrogen, about 10 kilos. With corresponding mixtures of acetylene and coal gas, the values are about 7 kilos., 12 kilos., and 40 kilos. respectively. These values will be lower, especially at low pressures, the larger the volume of the gas, and consequently the smaller the cooling influence of the walls of the vessel.

The limits at which the probability of propagation of the decomposition becomes 1/2 are somewhat higher in each case, but not much higher than those specified. The greater influence of coal gas as compared with hydrogen is to be attributed to the presence of a large proportion of methane, the decomposition of which would necessitate a considerable absorption of heat. C. H. B.

Principle of Maximum Work. By DONATO TOMMASI (*Bull. Soc. Chim.*, 1898, [iii], **19**, 439—441).—When a solution containing copper and silver nitrates is electrolysed, the latter salt does not undergo decomposition until the atomic proportions of copper and silver present in the solution are as 15 to 1; when the ratio becomes 87 to 2, the product of electrolysis consists of copper and silver in atomic proportion (1 : 1). According to the principle of maximum work, the whole of the silver should be precipitated before the copper nitrate begins to decompose.

A solution of potassium chlorate, when electrolysed, ought to undergo reduction rather than oxidation, according to this principle, since the former reaction, $KClO_3 + 3H_2 = KCl + 3H_2O$, generates 224·4 Cal., whereas the latter, $KClO_3 + O = KClO_4$, only liberates 17·6 Cal. As a matter of fact, it is the latter reaction which takes place.

An acidified solution of hydrogen peroxide, when electrolysed, evolves hydrogen, due to the decomposition of the water, but the peroxide is not reduced, although its reduction would be accompanied by a development of heat. If a solution of copper sulphate and hydrogen peroxide is placed in contact with the platinum anode of a voltaic cell and the circuit completed, copper is deposited, but the peroxide remains unaltered.

From these observations, the following generalisations are deduced:—(1) If a substance is treated in such a manner that it can react in one of two ways, the more exothermic reaction will occur, provided that this is capable of being started. (2) When two modes of action are possible, that reaction will take place which requires less energy to start it, although it may be less exothermic than the other.

The author proposes to replace the above-mentioned principle by another—the principle of minimum work—which may be enunciated in the following manner: Whatever be the amount of heat generated or absorbed during the course of a chemical change, the reaction which can be started with the least expenditure of energy will take place by preference. G. T. M.

New Compressed Air Pump. By PAUL BOURCET and G. BERLEMONT (*Bull. Soc. Chim.*, 1898, **19**, [iii], 479).—The lower portion of a filter pump is fitted into the central stopper of a three-necked Woulf's bottle; the upper portion is attached to a water tap. The Woulf's bottle is also fitted with an outlet tube for delivering the compressed air, and a syphon so regulated that one-third of the bottle remains filled with water when the pump is working. G. T. M.

Hydrogen Sulphide Generator. By WALTER P. BRADLEY (*Amer. Chem. J.*, 1899, **21**, 370—376).—The apparatus consists of three glass bottles, A, B, and C, each provided with an orifice near the bottom. The generator proper, A, has a capacity of about 16 litres, and should never be less than half full of large pieces of ferrous sulphide; it is not connected directly with the acid reservoir, B (8 litres), but indirectly by means of the third bottle, C, which serves as a gas reservoir, and has a capacity of about 4 litres; B and C are connected by the lower tubulures. The connection between C and A is by a tube which just passes through the top orifice in each and terminates in A as a fine capillary.

The acid reservoir may be fixed permanently at a convenient height above A, or may be so arranged that its height can be varied according to the pressure to be overcome. When gas is being drawn off from A, a small quantity of acid flows in through the capillary tube on to the sulphide; when the demand ceases, the gas formed accumulates in C; on renewed demand for gas, first the accumulated gas, then fresh acid, passes from C into A. The advantage of the method is that the acid remains in contact with the iron sulphide until it is spent and can then be removed by the lower orifice in A. J. J. S.

[Apparatus similar in principle have been in use in the laboratories of the Mason University College and the Central Technical College for some years.—EDITOR.]

Inorganic Chemistry.

New Explosive and Detonating Materials. By UGO ALVISI (*Gazzetta,* 1899, **29**, i, 121—143).—The author claims priority in the preparation of explosives containing ammonium perchlorate as their principal constituent. By using this salt in place of the other oxidising components of explosives, or by adding it to such explosives as contain enough oxygen for their combustion, an increase is obtained both in the ballistic and in the disruptive power. Also the ratio of the disruptive to the ballistic power has a higher value, which makes these explosives of especial use in mines.

Mixtures of ammonium perchlorate with carbon and with carbon and sulphur give good results as regards their hygroscopic properties, resistance to shock, keeping quality, &c. T. H. P.

Action of Hydrogen Peroxide on Halogen Oxy-acids. By SIMEON M. TANATAR (*Ber.*, 1899, **32**, 1013—1015).—Hydrogen peroxide has no action on perchloric or chloric acids in alkaline or in acid solution. Periodic acid is reduced to iodic acid in alkaline or acid solution, but the iodic acid is stable. Bromic acid is reduced to hydrogen bromide, together with a little bromine, since hydrogen bromide is oxidised by hydrogen peroxide. T. M. L.

Absence of Free Iodine and Gaseous Iodides in the Atmosphere of Toulouse. By F. GARRIGOU (*Compt. rend.*, 1899, **128**, 884—885).—A large volume of air from this town was filtered through cotton wool and aspirated through a solution of pure caustic potash; the residue obtained on evaporating the solution was treated with alcohol, and the extract, after distilling off the solvent, left a slight deposit which, on treatment with dilute sulphuric acid, zinc nitrite, and starch solution, proved to be free from iodides.

The steam evolved from the brine pans of Salies-de-Béarn, contains a notable quantity of sodium chloride, but no trace of iodides.

G. T. M.

Machines for the Manufacture of Liquid Air. By CARL LINDE (*Ber.*, 1899, **32**, 925—927).—The author points out that numerous proposals have been made at various times to produce a cumulative cooling effect by allowing a compressed gas to expand and thus cool a further quantity of the compressed gas. He claims to have been the first to utilise the Thomson-Joule effect for the production of cold in this way, and points out that Ramsay (*Ber.*, 1898, **31**, 3116) is in error in ascribing an earlier use of this principle to Hampson. A. H.

Molecular Weight of Sulphur. By SAMUEL D. GLOSS (*J. Physical Chem.*, 1898, **2**, 421—426. Compare Abstr., 1888, 1027; 1889, 673; 1890, 447, 1043; 1891, 260; 1896, ii, 357).—The molecular weights of monoclinic, rhombic, and plastic sulphur have been determined by the freezing point method in solution in naphthalene and in phosphorus, care being taken to avoid heating much above the melting point. For concentrations of 1 or 2 per cent. in naphthalene solutions, the values found were $M = 287$ and 271 for rhombic, 283 for plastic, and 293 for monoclinic, no marked differences being observed between the three varieties. The addition of 11 per cent. of sulphur to phosphorus brought the melting point down to 27°, and gave the values $M = 259$ for rhombic, and 260 for monoclinic sulphur; a further addition of 3 per cent. gave $M = 317$ for rhombic, 311 for monoclinic, and 329 for plastic sulphur; these values are higher than those obtained for an 11 per cent. solution, but are chiefly important as showing that no difference in molecular weight can be detected between the three forms, even when the temperature is kept below 27°.
T. M. L.

Molecular Weight of Sulphur in Carbon Bisulphide Solutions. By H. T. BARNES (*J. Physical Chem.*, 1899, **3**, 156—159. Compare this vol., ii, 405).—From Pfeiffer's density determinations (Abstr., 1897, ii, 488), the number of molecules of solvent that are displaced by a molecule of sulphur is calculated, and it is shown that S_4 and CS_2 have approximately the same molecular volume; it is therefore concluded that the molecule of sulphur has the formula S_{4n}, where the magnitude of *n* depends on the complexity of the molecule of carbon bisulphide.
T. M. L.

Combination of Sulphur with Hydrogen. By DMITRI P. KONOWALOFF (*Chem. Centr.*, 1898, ii, 657; from *J. Russ. Chem. Soc.*, 1898, **30**, 371—374).—The author finds that the results of his work on the combination of trimethylethylene with acids (Abstr., 1888, 1167) do not agree with Duhem's theory (Traité élémentaire de mécanique chimique fondée sur la thermodynamique) and Pélabon's data (Abstr., 1897, ii, 312), which show that the combination of sulphur and hydrogen at 215—350° reaches a limit which is not dependent on the reverse change, for hydrogen sulphide is not decomposed at these temperatures. According to the author, however, although hydrogen sulphide is not decomposed at 310°, there is no limit to the combination of hydrogen and sulphur at this temperature.
E. W. W.

Hydroxylamine. By SIMEON M. TANATAR (*Ber.*, 1899, **32**, 1016. Compare this vol., ii, 285).—The product obtained by the action of sulphurous acid on hydroxylamine was pure ammonium sulphate, and not sulphamic acid, although this is evidently the first product of the action. In reply to Brühl, it is stated that the similarity of behaviour between hydroxylamine and hydrogen peroxide does not necessarily imply similarity of structure.
T. M. L.

The Heteromorphic (Allotropic) Modifications of Phosphorus and Arsenic, and of Ferrous Sulphide. By GOTTLOB ED. LINCK (*Ber.*, 1899, **32**, 881—897).—The term *eutropic* is applied to any series formed by the combination of the successive elements of a subgroup of the elements in the natural system with the same radicle, when the compounds thus produced are characterised by similar crystalline form and similar physical and chemical constants, which, however, show a progressive change with the change in molecular weight. The *crystal-volume* of a substance can be calculated from the geometrical constants of its crystals (Linck, *Zeit. Kryst. Min.*, 1896, **26**, 280), and it has been found that the true molecular volume stands in a simple integral proportion to this calculated crystal-volume. It further follows from this that the relative weights of the crystal molecules of allotropic substances also stand to one another in a simple ratio.

Red phosphorus crystallises in rhombohedra of the hexagonal system, but this form is not eutropic with the ordinary rhombohedral forms of arsenic, antimony, and bismuth, because the properties of rhombohedral phosphorus, such as the calculated ratio of the axes, the atomic volume, behaviour towards oxygen, &c., do not fit into the eutropic series formed by the other three elements. On the other hand, red phosphorus appears to form a eutropic series with mirror arsenic, which has a sp. gr. 4·71, is transparent in thin films, and passes into the ordinary crystalline form of arsenic at 358—360°. Finally, ordinary yellow phosphorus corresponds eutropically with the yellow modification of arsenic. The latter is best obtained by gently heating arsenic in a current of carbonic anhydride and strongly cooling the tube, which must not be exposed to light; under these circumstances, a yellow powder is deposited, which is converted into the mirror form of arsenic by heat or exposure to light. This yellow powder is readily soluble in carbon bisulphide, and by evaporating the solvent is deposited in microscopic, rhombic dodecahedra which smell strongly of garlic. These change spontaneously into mirror arsenic, and the transformation, which can be watched under the microscope, is complete in about 3 minutes. No corresponding form of antimony or bismuth is known, whilst the ordinary opaque rhombohedral form of arsenic corresponds eutropically with crystalline antimony and bismuth, no form of phosphorus corresponding with these being known.

No definite difference in composition has been established between magnetic pyrites and artificial ferrous sulphide on the one hand, and troilite on the other. The first two crystallise in forms belonging to the hexagonal system, whilst troilite is stated to belong to the regular system. Troilite, however, cannot be a heteromorphic form of magnetic pyrites, because the weights of the crystal molecules of these substances do not stand in a simple integral proportion to each other. The conclusion is therefore drawn that troilite in reality belongs to the hexagonal system and has been formed in presence of excess of iron, whereas magnetic pyrites has been produced in presence of excess of sulphur. A. H.

Metaphosphoric Acids. By SIMEON M. TANATAR (*Chem. Centr.*, 1898, ii, 257; from *J. Russ. Chem. Soc.*, 1898, **30**, 99—103).—The yield of sodium trimetaphosphate obtained by Fleitmann's method of heating sodium ammonium hydrogen phosphate until neutral, is considerably improved by allowing the molten mass to cool only very slowly. The heat of solution of the trimetaphosphate in water is −0·547 Cal., that of the monometaphosphate in an equivalent quantity of hydrochloric acid or of sulphuric acid is nil, and that of silver metaphosphate, $AgPO_3 + \frac{1}{3}H_2O$, is −1·683 Cal. in water and +13·893 Cal. in hydrochloric acid. The heat of neutralisation of trimetaphosphoric acid with sodium hydroxide is +15·551 Cal. *Ethylic trimetaphosphate*, prepared by heating the silver salt with ethylic iodide in absolute alcohol, is insoluble in benzene and cannot be volatilised without decomposition. *Ethylic dimetaphosphate* has a sp. gr. 1·230, is insoluble in benzene, and also decomposes when heated; the sodium and silver salts are not attacked by cold acids.

E. W. W.

Arsenic Compounds. By Alfred Partheil and E. Amort (*Arch. Pharm.*, 1899, **237**, 121—127).—*Action of arsenic hydride on mercuric chloride.*—The results obtained confirm those of previous observers. When arsenic hydride, largely diluted with hydrogen, is passed into a solution of mercuric chloride in alcohol, the first product is yellow chloromercurarsine, $AsH_2 \cdot HgCl$. By passing in more arsenic hydride, orange di- and brown tri-chloromercurarsine and black arsenic mercuride, $AsH(HgCl)_2$, $As(HgCl)_3$, and As_2Hg_3, are obtained in succession. The first two decompose gradually in presence of a solution of mercuric chloride, yielding arsenious acid, hydrochloric acid and mercurous chloride. The third yields mercurous chloride and arsenic under these circumstances; moreover, it is easily decomposed by water, with formation of arsenious acid, hydrochloric acid, and mercury. Arsenic mercuride, when dry, oxidises readily in the air to arsenious oxide and mercury.

C. F. B.

Decomposition of Carbonic Oxide in Presence of Metallic Oxides. By O. Boudouard (*Compt. rend.*, 1899, **128**, 822—824).—The decomposition of carbonic oxide at 650° in presence of ferric oxide, nickel oxide, and cobalt oxide is a function of the time, and within certain limits depends on the quantity of metallic oxide present. Whereas at 445° the decomposition is complete (this vol., ii, 287), at 650° it is limited, and in presence of cobalt oxide decomposition ceases when the gaseous mixture contains 61 per cent. of carbonic anhydride and 39 per cent. of carbonic oxide.

C. H. B.

Decomposition of Carbonic Anhydride in Presence of Carbon. By O. Boudouard (*Compt. rend.*, 1899, **128**, 824—825).—Carbonic anhydride was heated at 650° with wood charcoal and with carbon obtained by the decomposition of carbonic oxide. In both cases, the proportion of carbonic oxide in the gas gradually increased, the reaction being more rapid with the wood charcoal than with the other. The limit of the reaction with wood charcoal was reached after 12 hours, and the composition of the gaseous mixture—CO_2, 61 vols., CO, 39 vols.—is identical with the composition of the gas at the limit of the reaction between carbonic oxide and cobalt oxide at the same temperature (preceding abstract).

C. H. B.

Silicomesoxalic Acid. By LUDWIG GATTERMANN and E. ELLERY (*Ber.*, 1899, **32**, 1114—1116).—Silicon octochloride, Si_3Cl_8 (Gattermann and Weinlig, Abstr., 1894, ii, 414), is best obtained by acting with chlorine on silicon in the preparation of which an excess of magnesium has been employed; if the whole of the magnesium silicide has been previously removed by extracting the silicon with hydrochloric acid, little of the octochloride is obtained, so that its formation appears to be due to the presence of the silicide.

When the purified octochloride is left exposed to the air in a platinum dish at 0°, hydrogen chloride is evolved, and *silicomesoxalic acid*, $Si(OH)_2(SiOOH)_2$, obtained as a white powder, which does not dissolve in cold water, but is decomposed by hot, giving rise to hydrogen and silica; the acid, when dry, is extremely unstable, and often decomposes spontaneously, becoming incandescent; it rapidly reduces a warm alkaline solution of potassium permanganate.

W. A. D.

Silver Suboxide. By ANTOINE GUNTZ (*Compt. rend.*, 1899, **128**, 996—998).—When dry silver oxide is heated at 358° for 40 hours in a closed tube fitted with a manometer, the pressure remains stationary at 49 atmospheres; if this temperature is maintained while some of the oxygen is allowed to escape, the pressure falls and then rises until the maximum is again attained. Two tared open tubes, one containing silver and the other silver oxide, were heated in a sealed tube containing so much potassium permanganate that when the temperature was raised to 358° the pressure of the liberated oxygen exceeded 49 atmospheres. After remaining at this temperature for three days, the tube was rapidly cooled, and the enclosed tubes weighed; the one containing silver had gained 3·88 per cent. in weight, whereas that containing silver oxide had lost 3·39 per cent. The gain in weight calculated on $4Ag + O = Ag_4O$ should be 3·67, whilst the loss calculated on $2Ag_2O = Ag_4O + O$ should be 3·44. This experiment indicates that the dissociation pressure of the sub-oxide Ag_4O at 358° is approximately 49 atmospheres. G. T. M.

Solubility of Ammonia in Aqueous Solutions of Silver Nitrate. By DMITRI P. KONOWALOFF (*Chem. Centr.*, 1898, ii, 659; from *J. Russ. Chem. Soc.*, 1898, **30**, 367—374).—If in the case of saturated solutions of ammonia in aqueous solutions of silver nitrate, twice the number of molecules of silver nitrate present is subtracted from the number of dissolved molecules of ammonia, the remaining ammonia shows the same solubility as in pure water, and Henry and Dalton's law is applicable. The same formula, $H = 56·58\ (m - 2n)$, applies in both cases, where H is the vapour tension of the ammonia in millimetres of mercury, m the number of molecules of ammonia, and n the number of molecules of silver nitrate in 1 litre. The solubility of ammonia in aqueous solutions of the compound $AgNO_3,2NH_3$ is, as in the case of its solution in ammonium or sodium nitrate solutions, the same as in pure water. E. W. W.

Preparation and Properties of Crystallised Calcium Phosphide. By HENRI MOISSAN (*Compt. rend.*, 1899, **128**, 787—793).—Calcium phosphide, Ca_3P_2, can be obtained in a crystalline form by heating an intimate mixture of calcium phosphate, 310 parts, and lamp black, 96 parts, in an electric furnace with a current of 950 ampères and 45 volts, also by heating the amorphous phosphide with a current of 800 ampères and 50 volts. It is red-brown in colour, melts with difficulty except in the electric furnace, and has a sp. gr. 2·51 at 15°. If the action of the electric arc is continued too long, part of the phosphide is decomposed.

When phosphorus vapour is passed over calcium heated to dull redness in a vacuum, calcium phosphide is formed with incandescence, but the product is amorphous. Calcium phosphide is not affected by hydrogen or nitrogen at 900°, but at 1200° is slightly decomposed by the latter and a small quantity of nitride is formed. Boron and carbon are without action at 700°, but at a higher temperature carbon converts it into calcium carbide. Arsenic has no action at the melting point of glass.

Chlorine has no action on the phosphide in the cold, but attacks it readily at about 100°, and bromine and iodine behave in the same way at somewhat higher temperatures. Oxygen and sulphur decompose the phosphide with incandescence at about 300°. Oxidising agents, including nitrous and nitric oxides, attack it very readily at a red heat, and the halogen hydracids decompose it with great energy. Concentrated nitric and sulphuric acids are without action, but in presence of water the phosphide is rapidly decomposed. Water acts somewhat slowly on the crystallised phosphide, and if it has been heated sufficiently in the electric furnace, the liberated hydrogen phosphide is not spontaneously inflammable; the reaction is complex and all the phosphorus is not liberated in the form of hydride. Ordinary organic solvents have no action on the phosphide. C. H. B.

Reduction of Calcium Phosphate by the Carbon of the Electric Arc. By ALBERT RENAULT (*Compt. rend.*, 1899, **128**, 883—884).—A mixture of carbon and tricalcium phosphate is introduced into an iron or carbon crucible forming the cathode of an electric arc, and the carbon anode is thrust into the crucible until the current passes. When the circuit is made, fumes containing phosphorus are evolved, and resistances are introduced until the evolution of vapour ceases; in one experiment, this result was attained with a current of 20 ampères and an E.M.F. of 22 volts. The product consists of calcium phosphide, Ca_3P_2 (compare preceding abstract), which is obtained in reddish granules embedded in a mixture of carbon and unaltered phosphate. The phospide has a crystalline fracture, but is so readily decomposed by moisture that the surface exposed becomes rapidly coated with white calcium hydroxide. When treated with water, it evolves gaseous hydrogen phosphide, which is entirely absorbed by copper sulphate, and is not spontaneously inflammable. Under certain conditions, a mixture of calcium phosphides is obtained which gives rise to both liquid and gaseous hydrogen phosphides. G. T. M.

Solubility of Tricalcium Phosphate and Apatite in Water. By JULES JOFFRE (*Bull. Soc. Chim.*, 1898, [iii], **19**, 372—375).—One litre of water was found to dissolve 0·009 gram of tricalcium phosphate and 0·002 gram of apatite, whilst in water saturated with carbonic anhydride at the ordinary pressure the solubilities were 0·153 and 0·014 gram per litre respectively. These results were obtained by leaving the substances in contact with water for about two months, filtering, and estimating the phosphoric acid in the filtrate as ammonium phosphomolybdate. The author is of opinion that the vegetable acids contained in the roots of plants have no action on phosphates, the solution of the latter being effected mainly through the agency of carbonic anhydride. Superphosphate, when applied to the soil, is by the action of the calcium carbonate present converted gradually into tricalcium phosphate, which is thus disseminated through the soil in a condition favourable to the solvent action of water.

N. L.

Phosphorescence of Strontium Sulphide. By José R. Mourelo (*Compt. rend.*, 1899, **128**, 557—559).—Strontium sulphide shows a more intense and persistent phosphorescence when excited by diffused light than when exposed to direct sunlight. Calcium, barium, and zinc sulphides show the same peculiarity. Exposure to diffused light makes the strontium sulphide more sensitive to subsequent exposures, whereas exposure to direct sunlight reduces the sensitiveness and may destroy it altogether. By repeatedly exposing strontium sulphide for a short time to diffused light, it becomes so sensitive that marked phosphorescence is excited by the light of one candle. The same sulphide shows intense phosphorescence when heated at a temperature considerably below a red heat.

If an unexposed tube of the sensitive sulphide is placed in a box between two tubes of exposed and phosphorescing sulphide, it is found after a time that phosphorescence in the middle tube has been excited by the others. Further, if a considerable mass of the sulphide is exposed under such conditions that only the surface is affected by light, and is then placed in the dark, it is found after a short time that the whole mass is phosphorescent, but shows zones of decreasing intensity; this phenomenon the author calls *auto-excitation*. C. H. B.

Occurrence of Barium Compounds in Artesian Well Water. By John White (*Analyst*, 1899, **24**, 67—71).—Samples of water obtained at different times from an artesian well at Ilkeston, Derbyshire, contained soluble barium compounds, the amount, expressed as barium chloride, on two occasions reaching 38·55, and 40·70 parts per 100,000. This abnormal water is believed to have come, not from the bottom of the boring (1801 feet), but to have obtained access by a fracture of the steel lining of the bore-hole.

L. de K.

Mixed Halogen Salts of Lead. By Victor Thomas (*Bull. Soc. Chim.*, 1898, [iii], **19**, 598—603).—Since Herty and Boggs (Abstr., 1898, ii, 585) were unable to confirm the existence of a definite lead chloriodide of the composition PbICl, the action of lead chloride on lead iodide has been studied, and it is found that the chloriodide is always produced, although the extent to which it is accompanied by chloride and iodide, and the order in which the compounds crystallise from the solution, depend on the experimental conditions. Against the view that the substance in question is an isomorphous mixture, it is urged (1) that by the action of nitric peroxide it is converted into the oxychloride, Pb_2OCl_2, and not into a mixture of chloride and oxide; (2) that it is readily attacked by hydrochloric acid, which is not the case with a mixture of chloride and iodide; (3) that it is extremely sensitive to light, unlike lead chloride and iodide; (4) that lead chloride and iodide crystallise in different systems; (5) that analyses of the products obtained by successive crystallisations indicate the existence of the chloriodide, as is shown graphically.

No compound containing both chlorine and bromine could be obtained by the action of hydrochloric acid on lead bromide, or of hydrobromic acid on lead chloride. If, however, 10 c.c. of a 10 per cent. solution of potassium bromide is added to a boiling solution of 5 grams of lead chloride in 240 c.c. of water and the liquid slowly cooled, aggregates of cruciform crystals of the composition $3PbCl_2,PbBr_2$ are obtained. This compound is not affected by light, and is insoluble in acetic acid and in chloroform; it is soluble in water, by which it is more or less decomposed, and is also readily decomposed by hydrochloric, hydrobromic, nitric, and nitrous acids.

A lead bromochloride of the composition PbBrCl, which will be subsequently described, has been obtained by an indirect method.

N. L.

Preparation and Properties of Crystalline Copper Subphosphide. By Georges Maronneau (*Compt. rend.*, 1899, **128**, 936—939).—A copper phosphide having the formula Cu_2P is produced by heating a mixture of copper phosphate and petroleum carbon in the electric furnace for 3—5 minutes with a current of 900 ampères and an E.M.F. of 45 volts. The product, which consists of crystals of the phosphide embedded in metallic copper, is disintegrated by being placed at the cathode of an electrolytic cell containing a saturated solution of copper sulphate; the crystalline deposit is collected and washed with water, alcohol, or ether, and lixiviated with bromoform to remove particles of graphite. The copper phosphide of commerce, when submitted to this treatment, also gives a crystalline deposit of the phosphide Cu_2P. This substance was first obtained by Schrötter, and it has also been prepared by other investigators (Abstr., 1898, ii 474). Its specific gravity is 6·4. When heated at 1000° in an atmosphere of hydrogen, it loses some of its phosphorus; fluorine attacks it at ordinary temperatures, and iodine only at temperatures somewhat below red heat; when warmed in contact with oxygen or sulphur, it is decomposed, yielding oxides or sulphides. It dissolves in nitric acid, aqua regia, and a mixture of nitric and hydrofluoric acids; the latter acid alone has no action on it, and neither has acetic acid, but it is slowly decomposed by hydrochloric and sulphuric acids. G. T. M.

Action of Hydrogen Sulphide and Alkali Sulphides on Double Cyanides: Cyanosulphides. By Marcellin P. E. Berthelot (*Compt. rend.*, 1899, **128**, 706—715).—When freshly precipitated silver sulphide is treated with potassium cyanide solution, a colourless solution is obtained which contains silver potassium cyanide, potassium sulphide, and excess of potassium cyanide.

Hydrogen sulphide produces a brown coloration, but no precipitate; if, however, the liquid is mixed with acetic acid, an abundant precipitate of silver sulphide is formed. Further, if the original solution is boiled, it becomes brown, and on now adding hydrogen sulphide or acetic acid, silver sulphide is precipitated. Similarly, if hydrogen sulphide is added to a solution of silver cyanide in excess of potassium cyanide, it first produces a coloration, and subsequently a precipitate, but the filtrate contains a silver salt and hydrogen cyanide and hydrogen sulphide, both the latter being displaceable by air.

In presence of only a slight excess of potassium cyanide, the action of the hydrogen sulphide is complete; a considerable excess of the cyanide is necessary to keep the silver in solution. Sodium sulphide behaves in the same way as hydrogen sulphide.

In the solutions there is a complex condition of equilibrium between hydrogen sulphide, hydrogen cyanide, and silver potassium cyanide, dependent on the relative stability of hydrogen silver cyanide and silver potassium cyanide, which is increased by the presence of excess of potassium cyanide, but reduced by an increase in temperature or the addition of acetic acid. The decomposition of silver potassium cyanide by hydrogen sulphide produces no thermal disturbance, and the occurrence of the reaction is determined by the removal of the silver sulphide from the sphere of action. In presence of excess of potassium cyanide, which produces a development of heat over and above that corresponding with the formation of silver potassium cyanide, there is no precipitation. If the pure double cyanide is mixed with a quantity of hydrogen sulphide insufficient for complete precipitation, an intermediate condition is produced, and there is development of heat. The action of potassium cyanide solution on freshly precipitated silver sulphide also causes considerable development of heat. The condition of equilibrium seems to correspond with the proportions $2AgK(CN)_2 + K_2S + 92KCN$, a double cyanide and sulphide being formed with development of heat.

Mercuric potassium cyanide shows no similar phenomena, the precipitation by hydrogen sulphide being complete. With sodium sulphide, the results are different, owing to the exothermic formation of a double sulphide. The mercuric sulphide is completely redissolved by the alkali sulphide, provided that it is present in proportion greater than that required by the formula $HgS + 2Na_2S$.

When zinc potassium cyanide is mixed with hydrogen sulphide or sodium sulphide, precipitation is slow, and in presence of an excess of potassium cyanide, not smaller than that required by the expression $Zn(CN)_2,2KCN + 6KCN$, no precipitation of zinc sulphide takes place at all. Freshly precipitated zinc sulphide is dissolved by potassium cyanide solution but is reprecipitated on boiling. The reaction $Zn(CN)_2 + 8KCN$ develops +10·8 Cal. or about +2·2 Cal. above the quantity representing the formation of the double cyanide. The reaction $[Zn(CN)_2,2KCN + 6KCN]$ diss. + H_2S diss. develops +5·0 Cal., but there is no precipitation of zinc sulphide even after a long time at the ordinary temperature. $ZnS + KCN$ diss. in excess develops +9·3 Cal. and a similar result is obtained if potassium cyanide solution is first mixed with sodium sulphide and zinc sulphate is then added. In the case of zinc, as in the case of silver, a double cyanide-sulphide is formed. C. H. B.

Reactions in Anhydrous Solvents. By Alexander Naumann (*Ber.*, 1899, **32**, 999—1004).—From a solution of mercuric chloride in ether, benzonitrile, ethylic acetate, benzene, or acetone, hydrogen sulphide precipitates all the mercury as the compound $2HgS,HgCl_2$. Dry ammonia precipitates the compound $HgCl_2,NH_3$ from a solution of mercuric chloride in benzonitrile, but $HgCl_2,2NH_3$ from a solution in ethylic acetate or methylal; stannous chloride gives a precipitate of mercurous chloride from all three solutions. Silver nitrate gives a precipitate of silver chloride when added to mercuric chloride dissolved in benzonitrile.

Hydrogen sulphide precipitates all the copper from a solution of cupric chloride in ethylic acetate as cupric sulphide; ammonia gives a precipitate of the compound $CuCl_2,6NH_3$, and hydrogen chloride a precipitate of $CuCl_2,2HCl$. Stannous chloride throws down cuprous chloride from a solution of cupric chloride in ethylic acetate, and cuprous chloride separates on cooling from a warm mixture of cupric chloride and stannous chloride in benzonitrile. On mixing cadmium iodide and cupric chloride dissolved in ethylic acetate, cuprous iodide and cadmium chloride are precipitated, whilst iodine remains in solution; all other metallic iodides give a similar reaction when dissolved in acetone.

Cupric chloride precipitates silver chloride from a solution of silver nitrate in benzonitrile; sulphur has no action in the cold, but precipitates silver sulphide on heating. Barium iodide and silver nitrate dissolved in pyridine give a precipitate of barium nitrate, leaving silver iodide in solution. Potassium thiocyanate and silver nitrate dissolved in pyridine give a precipitate of potassium nitrate.

The action of various metals, oxides, hydroxides, and salts on solutions of mercuric chloride, cupric chloride, and silver nitrate is also described. T. M. L.

Dissociation of Mercuric Oxide. By H. Pélabon (*Compt. rend.*, 1899, **128**, 825—828).—When mercuric oxide is heated in sealed tubes in presence of excess of oxygen, the limiting pressures of the oxygen between 440 and 620° are accurately represented by the equation $\log p = m/T + n \log T + z$, where T is the absolute temperature, the constants have the values $m = -27569$, $n = -57{\cdot}58$ and $z = +203{\cdot}94711$ and the logs. are common logs. At 440°, the pressure of the oxygen is only a few mm., and at 610° it is 1240 mm.

When the initial system consists of mercuric oxide only, the product of the pressure of the oxygen into the square of the pressure of the mercury vapour is a positive number depending only on the temperature, which is in agreement with Duhem's theory.

C. H. B.

Mercury Derivatives of Nitrogen Compounds. By Karl A. Hofmann and Eduard C. Marburg (*Annalen*, 1899, **305**, 191—222).—See this vol., i, 486.

Complex Oxides of the Rare Earth Metals. By Grégoire Wyrouboff and Auguste Verneuil (*Compt. rend.*, 1899, **128**, 501—503).—It is well-known that cerosoceric oxide, although when pure insoluble in nitric acid, becomes completely soluble in presence of lanthanum or didymium oxide. The authors find that the cerium oxide, Ce_3O_4, does not dissolve completely unless the proportion of lanthanum and didymium present corresponds with that required for the formula $Ce_3O_4,3MO$, where M is La or Di. A cerium oxide, $Ce_3O_4,3CeO$, is already known, and Brauner has described a sulphate corresponding with $Ce_3O_4,3LaO$. When heated in contact with air, the oxides $Ce_3O_4,3DiO$ and $Ce_3O_4,3LaO$, unlike the cerium oxide, do not oxidise, and if they become polymerised the change is not indicated by any difference in their behaviour with acids.

If the proportion of didymium or lanthanum is lower than that required to form the oxide $Ce_3O_4,3MO$, the strongly heated mixture will not dissolve in strong nitric acid, but dissolves in the dilute acid and forms a nitrate, $(Ce_3O_4,MO)_{16},4HNO_3 + 2H_2O$, which is precipitated by nitric acid from its aqueous solution, and has all the properties of the nitrate, $(Ce_3O_4)_{20},4HNO_3 + H_2O$, previously described; it yields an insoluble sulphate, and the oxide is not precipitated until at least half the acid has been saturated by the alkali hydroxide added. The precipitated oxide is white when lanthanum only is present, but deep brown if it contains didymium; it is insoluble in hydrochloric acid, and is attacked with difficulty by a mixture of hydrochloric acid and potassium iodide. When very strongly heated, it becomes $(Ce_3O_4,MO)_n$, where $n > 16$, and is insoluble in all acids except boiling sulphuric acid.

When the monoxides are present in lower proportion than is required to form the oxide Ce_3O_4,MO, a mixture of the nitrates, $(Ce_3O_4)_{20},4HNO_3 + 2H_2O$ and $(Ce_3O_4,MO)_{16},4HNO_3 + 2H_2O$, is obtained and cannot be resolved into its proximate constituents.

The existence of these stable complex oxides explains the rose or salmon colour of imperfectly purified cerium. Praseodymium oxide, Pr_3O_4 or $Pr_3O_4,3PrO$, can replace cerium in the molecule Ce_3O_4,MO.

Oxides of the yttrium group behave in the same way as those of the cerium group, and form corresponding complex oxides and nitrates.

These mixed oxides form polymerides analogous to, but much less stable than, the polymerides of the pure cerium oxides. They are somewhat difficult to prepare, but if a mixture of equal parts of the oxides, Ce_3O_4,LaO and DiO, is very strongly heated and then treated at 50° or 60° with 10 times its weight of dilute nitric acid (1 : 8), the supernatant liquid contains the excess of the monoxides, whilst the precipitate dissolves easily in water, and can be purified by reprecipitation with nitric acid. The nitrate has the composition $(Ce_3O_4,MO)_4,4HNO_3 + H_2O$, and is very deep garnet red when the monoxide is didymium oxide. Precipitation of the oxide does not begin until half the acid has been saturated by the alkali; the chloride is insoluble in hydrochloric acid, and the sulphate is insoluble and is decomposed by water and converted into a salt of the type $(Ce_3O_4,MO)_4,H_2SO_4$. C. H. B.

Nature of the Didymium accompanying Yttrium in Monazite Sands. By G. URBAIN (*Bull. Soc. Chim.*, 1898, [iii], 19, 381—382).—The didymium oxide which Boudouard separated from the yttrium metals of monazite sands, although exhibiting all the characteristics of neodymium, is not identical therewith, and contains a considerable proportion of other oxides. The spectrum shows, besides the bands of neodymium, Soret's X-bands and some very feeble bands of erbium and praseodymium. Fractional precipitation with potassium sulphate in alcoholic solution indicates the presence of metals of the terbium group, and fractionation with ammonia in presence of hydrogen peroxide shows the presence of cerium. Of the praseodymium bands observed, 4690 is quite distinct, whilst 4440 and 4820 are faint. N. L.

Properties and Applications of Aluminium. By Alfred Ditte (*Compt. rend.*, 1899, **128**, 793—799).—Alloys of aluminium with 3 per cent. of copper and with 5 to 6 per cent. of copper, together with about 1 per cent. of impurities, consisting chiefly of iron (0·29—0·37), silicon (0·37—0·54), and traces of carbon, behave in much the same way as pure aluminium in contact with dilute acids, saline solutions, &c. (this vol., ii, 292). When heated to dull redness, the surface becomes rough and vesicular, and if the metal is tempered in water, it acquires a confusedly crystalline structure and becomes brittle, the surface being covered with fine cracks.

Dilute sulphuric acid (2 : 100) dissolves the metal slowly, the surface becoming covered with a black layer of finely divided copper mixed with iron and silicon. The tempered metal behaves similarly, but acquires a somewhat different appearance.

Dilute solutions of alkali carbonates (2 : 100), sodium chloride solution (8 : 1000), and sea water, in presence of air, attack the alloys somewhat readily, the surface becoming covered with gelatinous aluminium hydroxide in which opaque, anhydrous aluminium oxide gradually separates (*loc. cit.*). Polished surfaces of the metal quickly lose their brightness and are attacked in a similar way.

Various articles of aluminium used by the French army in Madagascar were examined. Part of a portable cistern showed considerable deterioration: it was coated with aluminium hydroxide and oxide, was more or less disintegrated and brittle, and dissolved somewhat readily in dilute acids. This result was doubtless due to the presence of a small quantity of salt in the water. Smaller articles used for cooking and the like also showed considerable corrosion and disintegration, due to the action of the sodium chloride contained in the food, and of weak acids such as vinegar, or possibly the juices of fruit. C. H. B.

Application of Aluminium. By Henri Moissan (*Compt. rend.*, 1899, **128**, 895—901. Compare Abstr., 1894, ii, 450; 1896, ii, 301, 338; 1897, ii, 602; and 1898, ii, 118, 292).—Analyses are given showing the improvement which has been made in the quality of commercial aluminium during the period 1893—1897. The author disagrees with the conclusions drawn by Ditte from his experiments on the action of solutions of various acids, alkalis, and salts on the metal (see preceding abstract). An exhaustive trial of aluminium culinary utensils was made by the French army during the Madagascar campaign, and the satisfactory results obtained are distinctly in favour of the employment of aluminium for cooking utensils. The metal is easily stamped into vessels of the required shape, and the danger attending the use of soldered utensils is thereby avoided; aluminium vessels, moreover, are very easily cleaned. G. T. M.

Application of Aluminium. By ALFRED DITTE (*Compt. rend.*, 1899, **128**, 971—975).—In reply to Moissan's observations on the application of aluminium (see preceding abstract), the author points out that the thin layer of grease which is produced on aluminium cooking utensils cannot be removed except by the aid of alkaline solutions, and these have such an erosive action on the metal that the vessels are speedily rendered useless. The lightness of the metal, the ease with which it can be worked, and the innocuous character of its compounds are all points in favour of its application, but its great heat of combustion is a serious drawback. The value of this constant is 131 Cal.; it is twice as great as that of iron (64·4 Cal.), and almost equal to that of calcium (145 Cal.) G. T. M.

Double Iodates of Manganese [Tetriodate]. By ARMAND BERG (*Compt. rend.*, 1899, **128**, 673—676).—Hydrated manganese dioxide dissolves in a concentrated solution of iodic acid, forming a brown liquid from which it is impossible to separate manganic iodate in a solid form. In the presence of certain metallic iodates, double salts are produced of far greater stability.

Manganic potassium iodate, $Mn(IO_3)_4,2KIO_3$, obtained by boiling together iodic acid (3 mols.), hydrated manganese dioxide (1 mol.), and excess of potassium iodate, rapidly separates as an insoluble, brownish-violet, crystalline powder. The crystals are approximately cubic, and have scarcely any action on polarised light.

Manganic ammonium iodate, $Mn(IO_3)_4,2NH_4IO_3$, resembles the potassium salt, and is prepared in a similar manner.

Manganic barium iodate, $Mn(IO_3)_4,Ba(IO_3)_2$, produced by boiling the hydrated dioxide with the requisite amount of finely-powdered barium iodate and a slight excess of iodic acid, is precipitated as a yellowish-brown, crystalline powder mixed with colourless particles of barium iodate; the latter can be removed by levigation.

Manganosomanganic iodate, $Mn^{IV}(IO_3)_4,Mn^{II}(IO_3)_2$, is obtained either in small, bluish-grey needles or in dark violet, radiate clusters; its constitution may be that of a sesqui-salt, $Mn_2^{III}(IO_3)_6$. The sodium and calcium double iodates were not produced by the method which yielded the corresponding potassium and barium salts. G. T. M.

Absorption of Nitric Oxide by Ferrous Salts. By VICTOR THOMAS (*Bull. Soc. Chim.*, 1898, [iii], **19**, 419—422. Compare Abstr., 1897, ii, 145 and 262; also this vol., ii, 368).—The author has repeated and extended the experiments of Gay and Graham on the absorption of nitric oxide by ferrous salts, and confirms the results obtained by those observers. It is found that all ferrous salts, without exception, absorb nitric oxide in aqueous solution, and also when dissolved in alcohol, ether, acetic acid, or ethylenic bromide. The two latter solvents deposit ferrous salts in the anhydrous condition on evaporation, and hence it is inferred that the absorption is due to the salts themselves and not to their hydrates. The amount of nitric oxide absorbed depends on the nature of the solvent, and is greater for alcoholic than for aqueous solutions. N. L.

New Method for Preparing Iron Silicide. By PAUL LEBEAU (*Compt. rend.*, 1899, **128**, 933—936).—Iron silicide, FeSi, is conveniently prepared by heating a mixture of 10 parts of commercial copper silicide and 1 part of iron filings for 5 minutes in the electric furnace, a current of 950 ampères being employed with an E.M.F. of 45 volts; the cooled product exhibits a homogeneous fracture like that of copper silicide. It is broken up and treated with 50 per cent. nitric acid to decompose copper silicide, and when the whole mass is disintegrated, it is washed repeatedly with water and then heated with dilute caustic soda. The tetrahedric crystals of iron silicide thus obtained have a brilliant metallic lustre; they can be freed from the last traces of copper silicide by repeating the above treatment. The specific gravity of the crystals is 6·17 at 15°, and in hardness they are intermediate between quartz and corundum. The substance is not affected by oxygen or hydrogen at a red heat; fluorine attacks it at the ordinary temperature, forming iron fluoride, the substance becoming incandescent; chlorine and bromine produce a similar effect at a low red heat. The silicide is not attacked by mineral acids employed singly, but a mixture of nitric and hydrofluoric acids dissolves it completely; it is readily attacked by molten alkalis or mixtures of alkali nitrates and carbonates.

By the direct union of iron and silicon at the temperature of the electric furnace, Moissan obtained the lower silicide, Fe_2Si (Abstr., 1896, ii, 173), and by the direct action of carbon on tungsten the carbide CW_2 was produced. Williams (Abstr., 1898, ii, 594), by reducing tungstic acid with carbon in the presence of iron carbide, obtained the higher carbide CW. These results indicate that the presence of a metallic compound serving as a solvent gives rise to combinations of a different order from those which occur between the elements themselves, the chemical action being moderated by dilution with the solvent, so that the combination takes place at lower temperatures; both the silicide FeSi and the carbide CW are decomposed when heated alone at higher temperatures. Copper silicide at high temperatures readily gives up its silicon to cobalt, nickel, and chromium, and similar effects are observed in the case of the arsenide and antimonide of this metal. G. T. M.

NOTE.—For the action of zinc on copper silicide, see Abstr., 1898, ii, 474.

Hydrates of Cobalt Iodide and Ferric Bromide. By I. BOLSCHAKOFF (*Chem. Centr.*, 1898, ii, 660; from *J. Russ. Chem. Soc.*, 1898, **30**, 386—391).—By the action of iodine on cobalt under water, a red solution is formed from which the hydrate $CoI_2 + 6H_2O$ separates on slightly evaporating and then strongly cooling, whilst the mother liquor, on cooling, yields the hydrate $CoI_2 + 9H_2O$. The latter crystallises in thin, red, rhombic plates, is very hygroscopic, and loses $3H_2O$ at 6·4°.

The hydrate of ferric bromide, $FeBr_3 + 6H_2O$, separates in spherical clusters of small, dark green needles when the dark brown solution prepared by the action of bromine on iron under water is slightly evaporated and then placed in a desiccator over sulphuric acid; it is soluble in alcohol and ether, and melts at 27° without decomposing.

E. W. W.

Tungsten Bisulphide. By ED. DEFACQZ (*Compt. rend.*, 1899, **128**, 609—611. Compare Abstr., 1896, 912; 1898, ii, 521, and this vol., ii, 159).—Tungsten bisulphide is prepared, either by passing hydrogen sulphide over tungsten hexachloride heated at 375—550° or by fusing a mixture of potassium carbonate, flowers of sulphur, and tungsten trioxide. It is obtained by the former method in black, amorphous scales and by the latter in friable crystals with a blue reflex; it has a sp. gr. 7·5 at 10°. The substance is stable at red heat, but when heated in the electric furnace it gradually loses sulphur. It is reduced by hydrogen at 800°; fluorine attacks it at ordinary temperatures, chlorine at 400°, giving rise to the hexachloride, whilst the reaction with bromine is incomplete at 700°. Mineral acids, employed singly, are without action on the substance; it is, however, attacked by mixtures of nitric acid with hydrofluoric or hydrochloric acid. Molten alkalis and alkali carbonates dissolve it readily, and the method employed in its analysis is based on the solvent action of a fused mixture of potassium nitrate and carbonate.

G. T. M.

Bismuth Suboxide. By LUDWIG VANINO and F. TREUBERT (*Ber.*, 1899, **32**, 1072—1081).—As a consequence of Schneider's criticism (this vol., ii, 227), the authors have repeated and extended their experiments, and adhere to their former conclusion, that "the supposed bismuth suboxide is not to be regarded as a homogeneous substance, but as a mixture of bismuth and bismuth oxide." It is a mistake to suppose that they always used the stannous solution in excess. In all cases the precipitate obtained is a mixture of bismuth and bismuth oxide, which can be separated with glycerol and caustic soda, or with tartaric acid and caustic alkali, as well as with hydrochloric acid; the amount of metallic bismuth is always equivalent to the amount of stannous compound employed.

Schneider's chestnut brown solution of a supposed bismuthostannate, obtained by mixing bismuth tartrate with stannous chloride in neutral or feebly alkaline solution, probably owes its colour to the presence of colloidal bismuth in solution; the bulk of the stannous chloride is still present as such. When more alkali is added, less stannous salt, but more metallic bismuth, can be found in the solution.

The properties ascribed by Schneider to his supposed bismuth subsulphide, BiS, are found to be equally characteristic of an intimate mixture of finely divided bismuth and bismuth sulphide.

C. F. B.

Properties and Preparation of Bismuth Tetroxide and Bismuthic Acid. By CHRISTIAN DEICHLER (*Zeit. anorg. Chem.*, 1899, **20**, 81—120).—A critical account of the earlier work on the oxides of bismuth is given, the present research being undertaken in order to clear up the discrepancies which occur in the results of previous authors. A large number of experiments on the preparation of bismuth tetroxide and bismuthic acid by the action of chlorine on bismuth trioxide suspended in a solution of potassium hydroxide gave the following results: With potassium hydroxide of sp. gr. 1·05—1·5 at 15°, the bismuth trioxide is unaltered. With potassium hydroxide of sp. gr. 1·05—1·35 at 95—100° in the ratio $KOH : Bi_2O_3 = 10—20 : 1$, a mixture of tetroxide and trioxide is obtained which yields the tetroxide when treated with hot dilute nitric acid; the yield of tetroxide increases with the proportion and concentration of the potassium hydroxide. With potassium hydroxide of sp. gr. 1·35—1·38 at 100—110°, a mixture of potassium bismuthate, tetroxide, and trioxide is obtained which, when treated with hot dilute nitric acid, yields a mixture of the tetroxide and its hydrate, $Bi_2O_4,2H_2O$, and with hot concentrated nitric acid forms a small quantity of this hydrate. With potassium hydroxide of sp. gr. 1·39—1·5 at 110—120° in the proportion $KOH : Bi_2O_3 = 20—30 : 1$, a mixture of potassium bismuthate with lower oxides is obtained which, when treated with hot dilute nitric acid, yields a mixture of tetroxide, bismuthic acid, and potassium bismuthate and with hot concentrated nitric acid, if expeditiously treated, yields bismuthic acid, or when left in contact with it, the hydrated tetroxide; the yield of potassium bismuthate increases with the proportion and the concentration of the potassium hydroxide. With potassium hydroxide of sp. gr. 1·52—1·62 at 120—125° in the proportion $KOH : Bi_2O_3 = 10—30 : 1$, a mixture of potassium bismuthate with lower oxides containing alkali is obtained which, when treated with hot concentrated nitric acid, yields a mixture of bismuthic acid and hydrated tetroxide, the yield of bismuthic acid decreasing with the concentration of the potassium hydroxide.

Potassium bismuthate is easily prepared by the action of nascent chlorine on bismuth trioxide suspended in potassium hydroxide. Bismuth trioxide (10 grams) is mixed with potassium hydroxide (150 grams, sp. gr. = 1·42—1·45) and potassium chloride (15 grams) and the solution electrolysed in a platinum dish, using the dish as anode and a platinum plate as cathode, the latter being protected by a porous diaphragm in order to prevent the deposition of bismuth. A current density of 2—3 ampères per centimetre is employed, and the temperature is kept just below that of the boiling point of the solution. The bismuthate is deposited as a dense red precipitate which adheres firmly to the dish and is easily washed with water, the excess of bismuth trioxide remaining in suspension. When the potassium bismuthate is treated for a short time with hot concentrated nitric acid and then washed with water, a mixture of bismuthic acid and the hydrate $Bi_2O_4,2H_2O$ is obtained containing 95 per cent. of bismuthic acid. The author was unable to obtain the acid in a purer state. If dilute nitric acid is employed, a large quantity of $Bi_2O_4,2H_2O$ is formed and by the prolonged action of nitric acid of sp. gr. 1·3, the tetroxide dihydrate, $Bi_2O_4,2H_2O$, is obtained as an orange-yellow powder. The same compound is also obtained by the action of warm acetic acid on bismuthic acid. Potassium bismuthate, when heated at

120°, loses a small quantity of water and turns black; at 300°, two atomic proportions of oxygen are evolved and Bi_2O_3,K_2O, a yellowish-white substance, is obtained; this is extremely hygroscopic and absorbs water from the air with development of heat, and is decomposed into potassium hydroxide and bismuthic acid. Bismuthic acid, when heated at 100—120°, loses water and turns brown and then black with evolution of oxygen; at 300°, it suddenly turns bright red, and acquires the ordinary yellow colour of the trioxide at 400—500°. The bright red compound obtained at 300° is an allotropic modification of the trioxide; on cooling, it becomes golden yellow; when exposed to sunlight for a few days, it is converted into ordinary trioxide and does not turn red again on heating at 300°; if, however, it is kept in the dark in a closed vessel, it does not alter during two months and then gradually changes into the ordinary modification.

An examination of the electrolysed solution obtained in the preparation of potassium bismuthate shows that the trioxide and bismuthate are slightly soluble in strong potassium hydroxide solution and are obtained as a voluminous precipitate on dilution with water. Bismuthic acid is also slightly soluble, and is precipitated on dilution as bismuth tetroxide dihydrate. In the preparation of potassium bismuthate, the concentration of the potassium hydroxide must not fall below sp. gr. 1·4, as with a solution of sp. gr. 1·37, only a small quantity of bismuthate is deposited, and the suspended bismuth trioxide turns brown and is converted into the tetroxide.

Sodium bismuthate cannot be prepared by this method; no deposit of salt is obtained and the suspended bismuth trioxide turns brown; when the product is poured into water, a bright yellow precipitate is obtained which seems to be a mixture of sodium bismuthate and the trioxide.

When a solution of bismuth trioxide in an alkaline tartrate is oxidised by the electric current (1 ampère per centimetre), a small quantity of the anhydrous tetroxide is obtained, but with a higher current density, the trioxide is deposited. A small quantity of the tetroxide is also obtained by electrolysis in a nitric acid solution.

Bismuth trioxide is not altered when treated with barium peroxide either by fusion or by boiling in the presence of alkali, but is easily converted into the tetroxide by suspending it in potassium hydroxide solution and warming with an excess of potassium persulphate; the product is washed with water and then treated with warm dilute nitric acid or cold acetic acid. E. C. R.

Mineralogical Chemistry.

Humic Lignite and Humin. By C. Eg. Bertrand (*Compt. rend.*, 1898, **127**, 823—825).—Generalisations as to the formation of certain lignites deduced from the microscopic study of specimens (compare this vol., ii, 161).

Plagionite, Heteromorphite and Semseyite. By Leonard J. Spencer, with analyses by George T. Prior (*Min. Mag.*, 1899, **12**, 55—68).—The three minerals plagionite, heteromorphite and semseyite are very similar in appearance and physical characters, and the monoclinic crystals are the same in habit, striations, and the pyramidal cleavage (111); they differ in the specific gravity, percentage chemical composition, and in the length of the vertical crystallographic axis *c*.

	a : *b* : *c*	β.	Formula.	Sp. gr.
Plagionite	1·1361 : 1 : 0·8410 ;	72° 28′.	$5PbS,4Sb_2S_3$	5·5
Heteromorphite.	....	....	$7PbS,4Sb_2S_3$	5·7
Semseyite	1·1442 : 1 : 1·1051 ;	71° 4′.	$9PbS,4Sb_2S_3$	5·9

In the present paper, three specimens of these plagionite-like minerals are described in detail.

Plagionite from Wolfsberg in the Harz, gave the results under I, agreeing with those required for the formula $9PbS,7Sb_2S_3$, which lies between the two formulæ previously given for plagionite, namely, $4PbS,3Sb_2S_3$ and $5PbS,4Sb_2S_3$. The sp. gr. of the group of crystals is 5·57, and of the crystals analysed 5·50.

Heteromorphite occurs at Arnsberg, in Westphalia, as small, indistinct crystals, associated with blende, lining cavities in the massive crystalline material. Analysis II agrees with $11PbS,6Sb_2S_3$, which is not far from Pisani's formula $7PbS,4Sb_2S_3$. The name heteromorphite is usually placed under jamesonite, but, with Pisani (Abstr., 1877, i, 56), it is here considered to be a distinct species.

Semseyite from Wolfsberg, Harz, gave anal. III, pointing to the formula $21PbS,10Sb_2S_3$. The large crystals had been considered to be plagionite, but this analysis proves them to be identical with the semseyite from Hungary (Abstr., 1886, 313).

	Pb.	Sb.	S.	Cu.	Zn.	Total.	Sp. gr.
I.	41·24	37·35	21·10	—	—	99·69	5·50
II.	48·89	31·08	19·36	0·10	0·18	99·61	5·73
III.	51·84	28·62	19·42	—	—	99·88	5·92

All the previous analyses of plagionite-like minerals are quoted and arranged according to the percentage of lead, which varies from 39·36 to 53·16 per cent.; they then fall into three well-marked groups corresponding with the minerals in question. This variation in composition is not to be explained by the intergrowth of galena, or by isomorphous mixing, but it is more probable that the three minerals form a morphotropic series (Abstr., 1894, ii, 241; 1898, ii, 120), in which the vertical crystallographic axis increases in length with an increase in the amount of lead. The slight deviations from the three formulæ, $5PbS,4Sb_2S_3$, $7PbS,4Sb_2S_3$, and $9PbS,4Sb_2S_3$ are explained by the more or less parallel intergrowth of the three minerals, giving compound, curved crystals, which in these plagionite-like minerals are very common, so much so that the measurements here given are not sufficient to distinguish between them. L. J. S.

Blende and Zinciferous Galena. By Henry A. Miers, with analyses by E. G. J. Hartley (*Min. Mag.*, 1899, **12**, 111—117).—Blende with metallic lustre.—Bright tetrahedra, black in colour and with metallic lustre, gave analytical results (I) agreeing with those required for the formula $5ZnS,FeS$. Very thin fragments are brown by transmitted light. The lustre is so unlike that of ordinary blende that the question arises whether the union of ZnS and FeS in molecular proportion has not given rise to a mineral having properties distinct from those of a mere isomorphous mixture of the two sulphides.

	Zn.	Fe.	Pb.	Cu.	Mn.	S.	Total.	Sp. gr.
I.	56·83	9·29	—	0·07	trace	33·42	99·61	3·8
II.	4·97	0·67	78·47	—	—	15·07	99·18	

Zinciferous galena.—A specimen labelled Bingham, Salt Lake, Utah, consists of brilliant cubes of galena on quartz with pyrites. The small octahedral planes exhibit a marked laminar structure. No traces of blende are seen when the crystals are finely crushed. Analysis II gives the formula $4PbS,(Zn,Fe)S$. Previous examples of zinciferous galena have not been obtained in such distinct crystals, and may have been mixtures of galena and blende.

The paper also describes a tetartohedral (?) crystal of pyrites, and the minute cubic crystals of lead produced when a button of the cast metal is etched. L. J. S.

So-called "Favas" of Brazilian Diamond-sands. By Eugen Hussak (*Tsch. Min. Mitth.*, 1899, **18**, 334—341).—The name "fava" (bean, pea) is given to small, rounded or flattened pebbles of various colours, compact in structure, and with high specific gravity, which are found in the diamond washings of Brazil. Titanium oxide favas and zirconium oxide favas are described. The former of a blue-grey colour gave analysis I (by W. Florence); thin sections show a homogeneous microcrystalline aggregate of blue-grey grains resembling anatase in appearance. Yellow material gave analysis II; under the microscope, this suggests rutile. The blue-grey titanium oxide favas are the alteration product of perofskite; whilst the yellow-brown favas are paramorphs of rutile after anatase or brookite, or they are pseudomorphs of rutile and anatase after ilmenite. These minerals have been described by Damour and Gorceix as hydrated titanium oxide, but in no case do they contain more than 1 per cent. of water.

	TiO_2.	Al_2O_3.	Fe_2O_3.	CaO.	V_2O_5.	Loss on ignition.	Total.	Sp. gr.
I.	98·98	0·15	0·10	0·15	—	0·77	100·15	3·794
II.	98·86	—	—	—	0·86	0·53	100·25	3·8—3·95

The zirconium oxide favas contain over 97 per cent. of ZrO_2, and are, therefore, baddeleyite. Those coloured grey and with an earthy fracture have a sp. gr. 4·57—5·01, and contain 2·75 per cent. of water; others are brown to greenish-black and more compact, these have a sp. gr. 5·408, and contain less water (0·5 per cent.). The structure is microcrystalline, and thin sections show the original mineral to have been zircon. L. J. S.

Lead Minerals from Laurion: Paralaurionite. By G. F. Herbert Smith, with analysis by George T. Prior (*Min. Mag.*, 1899, **12**, 102—110).—Crystallographic and optical determinations are given of minerals from the ancient lead slags of Laurion in Greece. For laurionite, [$a:b:c=0·7385:1:0·8346$]; several new forms are noted; the refractive indices for sodium light are, $\alpha=2·0767$, $\beta=2·1161$, $\gamma=2·1580$. The refractive indices for phosgenite are, $\omega=2·1181$, $\epsilon=2·1446$ (Na). Fiedlerite has [$a:b:c=0·8299:1:0·7253$; $\beta=77°$ $31'$], and refractive indices $\alpha=1·816$, $\beta=2·1023$, $\gamma=2·026$ (Na).

The new mineral, *paralaurionite*, may at a cursory glance be easily mistaken for laurionite or fiedlerite, according as the crystals are prismatic or tabular in habit. It is monoclinic, but almost always pseudorhombic, owing to twinning on *a*(100) [$a:b:c=0·8811:1:0·6752$; $\beta=62°\ 47'$]. Cleavage *c*(001). The optic figure seen through *a*(100) is complex owing to the overlapping of two plates in twin position; in this respect, paralaurionite is easily distinguished from the dimorphous mineral laurionite which shows no figure, and from fiedlerite, in which the figure is not central. Index of refraction, 2·1463 (Na). Analysis agrees with the laurionite formula, PbClOH.

Pb.	Cl.	H_2O.	O.	Total.	Sp. gr.
78·1	14·9	3·4	[3·6]	100·0	6·05

The water is eliminated at about 180°, whilst for laurionite it is given off at 142°. L. J. S.

Belgian Minerals. By Giuseppe Cesàro (*Zeit. Kryst. Min.*, 1899, **31**, 89—96; from *Mém. Acad. Sci. Belg.*, 1897, **53**, 134 pp.).—A detailed description is given of the mineral phosphates, sulphates and carbonates found in Belgium; of the 29 species described, analyses are given of the following:

Phosphorochalcite (pseudomalachite), radially fibrous, with cuprouranite and libethenite in quartz from Viel-Salm; 22·99 P_2O_5, 63·88 CuO, also some Al_2O_3.

Hydrozincite from Bleyberg, dried over sulphuric acid, gave the formula $3ZnCO_3,4Zn(OH)_2+0·4H_2O$, as shown by the following results.

ZnO.	Fe_2O_3.	PbO.	$PbCl_2$.	CO_2.	H_2O.	Total.
72·41	0·42	0·36	0·51	16·90	11·31	101·91

L. J. S.

Chalcophyllite. By E. G. J. Hartley (*Min. Mag.*, 1899, **12**, 120—122).—In previous analyses of this mineral, the water has been determined only as loss on ignition, but owing to the presence of arsenic this is not satisfactory. In the present analysis, the water was weighed directly, and sulphuric acid has been found in the mineral for the first time. The material analysed consisted of clear, pale emerald-green crystals, probably from Cornwall. At 100°, there is a loss of 17·93 per cent. of water. When the mineral is heated, there is no change in the optical properties until the crystals suddenly become opaque and cracked.

CuO.	Al_2O_3.	As_2O_5.	SO_3.	H_2O.	Total.
45·93	4·74	14·46	7·04	28·26	100·43.

These numbers do not indicate any simple formula. L. J. S.

Minerals from Swaziland: "Æschynite" from Hitterö. By George T. Prior (*Min. Mag.*, 1899, **12**, 96—101).—A collection of minerals from the stanniferous gravels of the Embabaan district in Swaziland, South Africa, is described; it includes cassiterite, monazite, scheelite, corundum, magnetite, garnet, and minerals chemically allied to euxenite and fergusonite.

The "mineral chemically allied to euxenite" occurs as worn, tabular crystals, which in habit and angles are very similar to the large crystals from Hitterö, Norway, described by Brögger under the name of æschynite. It is brownish-black with brilliant vitreous to greasy lustre on the subconchoidal fracture, and has a sp. gr. 4·996. Thin splinters are translucent, yellowish-brown, and isotropic. The results of two analyses are as follows:

Nb_2O_5.	TiO_2.	SiO_2.	ThO_2.	SnO_2.	$(Y,Er)_2O_3$ (mol. wt. 246).	$(Ce,La,Di)_2O_3$ (mol. wt. 310).
36·68	21·89	2·12	0·61	0·29	17·11	4·32

UO_3.	UO_2.	FeO.	CaO.	MnO.	MgO.	H_2O.	Total.
2·14	0·49	5·63	4·12	0·19	0·22	3·69	99·50

The lanthanum and didymium oxides are present in about double the amount of the cerium oxides. Full details of the methods of analysis are given. In chemical composition, the mineral is more closely related to euxenite than to æschynite; the formula suggested is $2R_2O_3,4RO,6TiO_2,4Nb_2O_5,5H_2O$, or $R_2'''(TiO_3)_3,2R'''(NbO_3)_3 + 3R'(TiO_3),R'(NbO_3)_2 + 5H_2O$.

In connection with this, crystals from Hitterö agreeing with Brögger's description of "æschynite" were examined qualitatively and found to contain niobic and titanic acids, yttrium and cerium earths (the latter in much smaller amount than the former), with iron, uranium and calcium, and little or no zirconium or thorium. This result, which agrees with unpublished work by Brögger and Blomstrand, shows that the mineral from Hitterö, analysed by Jehn (1871) and termed by him euxenite, was identical with the crystallised material measured by Brögger: the mineral in question should therefore receive a new name.

Fergusonite (?), in small pebbles or rounded fragments intimately intergrown with monazite, was found to contain water, much niobic acid, iron, uranium, and yttrium earths, but very little titanic acid or cerium earths. Sp. gr. 5·43, 5·42.

Cassiterite crystals embedded in a quartz felspathic rock are remarkable in being elongated in the direction of the pyramid edge [111, $\bar{1}$11]; this orthorhombic habit is like that recently described for mossite and tapiolite (Abstr., 1898, ii, 387, 608).

Monazite in rough tabular crystals contains phosphoric acid and cerium earths with some silica and thoria. Sp. gr. 4·62. L. J. S.

Carnotite, a New Uranium Mineral. By CHARLES FRIEDEL and E. CUMENGE (*Compt. rend.*, 1899, **128**, 532—534).—A new mineral containing uranium and vanadium, to which the authors give the name *carnotite*, is found in yellow, friable masses, mixed with very variable quantities of silica, together with malachite and chessylite, in pockets at the surface of a grit in Montrose Co., Colorado. It is microcrystalline and optically active, but no definite forms could be recognised. The composition of carnotite is represented by the formula $2U_2O_3,V_2O_5,K_2O + 3H_2O$; it contains U_2O_3, 62·46—64·70; V_2O_5, 19·95—20·31; K_2O, 10·97—11·15; Fe_2O_3, 0·65—0·96; H_2O, 5·19, together with traces of copper, lead, and barium, and of the metals described by M. and Mdme. Curie, that give photographically active radiations. The relative radiating powers, as determined by M. and Mdme. Curie are native mineral, 1·25; mineral free from silica, 2·6; insoluble sulphates (barium and radium), 35; crude sulphides, 11; bismuth and polonium sulphides, 50 to 60. C. H. B.

Hardystonite, a New Calcium-zinc Silicate. By JOHN E. WOLFF (*Proc. Amer. Acad. Arts and Sci.*, 1899, **34**, 379—381).—A banded ore specimen from North Mine Hill at Franklin Furnace, New Jersey, consists of grains of willemite, rhodanite, franklinite, and the new mineral hardystonite, named after the Hardystone township in which the Franklin mines are situated. The last mineral is white to transparent with a vitreous lustre. H, 3—4; sp. gr., 3·397—3·395. It fuses with difficulty to a cloudy glass, and is easily gelatinised by hydrochloric acid. Microscopic examination of thin sections shows the mineral to be uniaxial and negative, with a good basal cleavage, and two sets of rectangular prism cleavages at 45° to one another; it is therefore tetragonal. Analysis of material containing a few specks of franklinite and willemite gave,

SiO_2.	ZnO.	MnO.	CaO.	MgO.	Fe_2O_3.	Loss on ignition.	Total.
38·10	24·30	1·50	33·85	1·62	0·57	0·52	100·46

Taking the manganese with the zinc, and the magnesium with the calcium, this gives the formula $ZnO,2CaO,2SiO_2$. L. J. S.

Hydrated Aluminium Silicates. By S. KASAI (*Zeit. Kryst. Min.*, 1899, **30**, 653; from *Inaug.-Diss. München*, 1896, 35 pp.).—Experiments have been made in order to test Groth's view (*Tabell. Uebers. d. Min.*) that the amorphous aluminium silicates, for example, allophane, are intimate mixtures of colloidal silica and colloidal alumina. Solutions of colloidal silica and alumina, when brought together, give an amorphous precipitate containing variable amounts of silica, alumina and water. Complete precipitation occurs only when the proportion is $3SiO_2 : Al_2O_3$; with other proportions, the excess partly remains in solution and is partly precipitated. These amorphous precipitates, in their variable composition and instability in the presence of acids, agree completely with the natural substances.

Kaolin has been considered by Schlœsing to exist in the colloidal as well as in the crystalline state, and to the minute globules of colloidal kaolin he attributed the plasticity of clay. The apparently amorphous globules in kaolin from Zettlitz, Bohemia, however, are seen under a high magnification to consist of feebly birefringent plates. Further, the plasticity of clay is only dependent on the degree of subdivision of the particles of crystallised kaolin. From the Zettlitz kaolin, dilute sulphuric acid extracts alumina, but very little silica, and analysis of the material after it has been treated with acid only gives the normal kaolin formula. In this case, the excess of alumina must be present as crystallised diaspore, bauxite, or gibbsite, these being very similar to kaolin in optical characters, and they may also, with kaolin, be derived from felspar. L. J. S.

A New Variety of Hornblende. By REGINALD A. DALY (*Proc. Amer. Acad. Arts and Sci.*, 1899, **34**, 433—437).—Goniometric measurements and optical determinations are given of crystals of hornblende from Philipstad, Sweden. The angle of optical extinction on the plane of symmetry is $\mathfrak{c} : c' = 15° 9'$, $2V = 50°$ about. Absorption, $\mathfrak{a}$ = light brownish-green, $\mathfrak{b}$ = dark yellow-green, $\mathfrak{c}$ = dark blue-green; $\mathfrak{b} > \mathfrak{c} > \mathfrak{a}$. Sp. gr. 3·275; for the inner, darker zone, 3·230, and for the outer, lighter zone, 3·195. An analysis by Pisani gave

SiO_2.	TiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	MnO.	CaO.	MgO.	Na_2O.	K_2O.	Loss on ignition.	Total.
45·20	0·84	7·34	7·55	15·80	1·52	12·30	8·40	0·80	0·37	0·70	100·82

This composition cannot be expressed by any definite formula. The reasons for considering this hornblende distinctive enough to receive the new name *philipstadite* are summarised as follows: "This hornblende is thus unique among the species yet described in that it possesses the combination of properties including an unusually small optic angle, an unusual pleochroism and absorption scheme, a well developed zonal structure, and quite anomalous etch-figures with hydrofluoric acid on the prism (110) and on the clinopinacoid." L. J. S.

Rocks from Antarctic Regions. By GEORGE T. PRIOR (*Min. Mag.*, 1899, **12**, 69—91).—Petrographical notes are given of the rock-specimens collected in Antarctic regions during the voyage of H.M.S. *Erebus* and *Terror*, under Sir James Clark Ross, in 1839—1843. The collection includes, for the most part, basalts, together with palagonite-tuff, phonolite, rhyolite, dolerite, epidiorite, granite, chert, calcareous glauconitic sandstone, quartz-grit, slate and gneiss; some of these are only represented by pebbles taken from the stomachs of seals and penguins. Analyses are given of the following:—

Silicified globigerinal limestone from Campbell Island (lat. 52° 33′ S., long. 169° 8′ E.) gave:

SiO_2.	$CaCO_3$.	$MgCO_3$.	$Al_2O_3(Fe_2O_3)$.	H_2O, &c.	Total.	Sp. gr.
57·46	39·26	0·36	1·48	[1·44]	100·00	2·15

Basalt (nepheline-basanite?) from Franklin Island (lat. 76° 8′ S., long. 168° 12′ E.), is a black, compact rock, with olivine, magnetite, augite, felspar and possibly nepheline; analysis I contains also a trace of tin.

Basalt from Cockburn Island (lat. 64° 12′ S., long. 56° 49′ W.) gave II; the material analysed was taken from a large specimen at seven inches from the outer zone of basalt-glass; analysis of the glass gave III. Towards the surface of the specimen, the glass increases, and the magnetite decreases, in amount.

	SiO_2.	TiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	MnO.	CaO.	MgO.	K_2O.	Na_2O.	Loss on ignition.	Total.	Sp. gr.
I.	45·61	3·48	15·70	6·17	7·29	trace	6·34	4·84	2·67	5·06	2·34	99·50	2·87
II.	48·97	1·62	16·12	1·90	9·63	trace	8·73	7·64	1·21	2·99	1·39	100·20	2·89
III.	50·22	1·95	16·20	3·13	8·07	trace	8·57	7·54	1·38	3·36	0·22	100·64	2·79

L. J. S.

A Tachylite from the Bottom of the North Atlantic. By PIERRE TERMIER (*Compt. rend.*, 1899, **128**, 849—851).—A specimen of rock dredged from the bottom of the Atlantic at a depth of 3100 metres, in latitude 47° 0′ N. and longitude 29° 40′ W. of Paris, was found to have all the microscopic and general characters of a tachylite or basaltic glass. Its high sp. gr., 2·784 at 20°, and the presence of a large proportion of olivine, indicate that it must have a highly basic character. It is noteworthy that this specimen was dredged from a part of the Atlantic where the bottom is known to be formed by the highest submarine mountain summits. C. H. B.

Chemical Changes in Oceanic Deposits. By W. Noel Hartley (*Proc. Roy. Soc. Edin.*, 1897, **21**, 25—34).—The views of Murray and Irvine (*Trans. Roy. Soc. Edin.*, **37**, pt. 2, No. 23, and *Nature*, 1895, **51**, 304) are criticised, and the following conclusions given: (1) The sulphates in fresh- and sea-water mud are reduced to carbonates and hydrogen sulphide by the fermentation of cellulose through the agency of bacteria. (2) There is no evidence of the formation of calcium sulphide or of calcium hydrosulphide. (3) Hydrogen sulphide is not oxidised simply by atmospheric air to sulphuric acid at the ordinary temperature. (4) Sulphur bacteria separate sulphur from hydrogen sulphide, and then oxidise it to sulphuric acid, which acts on the carbonates and again forms sulphates. (5) The formation of manganese carbonate appears to be due to an action on manganic oxide similar to that which operates on sulphates in the presence of fermenting cellulose.

John Murray and Robert Irvine reply to these criticisms in a later paper (*Proc. Roy. Soc. Edin.*, 1897, **21**, 35). L. J. S.

The Crodo Spring at the Juliushall Bath, Harzburg, Harz Mountains. By Robert Otto and Julius Troeger (*Arch. Pharm.*, 1899, **237**, 149—160).—The water was drawn on Sept. 28, 1893, and its temperature was then 9°, and its sp. gr. 1·0110 at 20°. The amount of total solids, directly ascertained, was 1656·2 after drying at 180—190°. The carbonic anhydride really free was 10·031 (= 5·074 litres per 100 kilos. at 0° and 760 mm.); the so-called free carbonic anhydride, namely that actually free together with that combined with the carbonates to form hydrogen carbonates, was 16·024 (= 8·105 litres). The other constituents, arranged in the conventional manner, were, in parts per 100,000,

SiO_2.	$Ca_3(PO_4)_2$.	$CaCO_3$.	$CaSO_4$.	KBr.	KCl.	$NaNO_3$.	Na_2SO_4.
1·680	0·074	13·445	39·59	0·196	20·885	0·510	57·63

NaCl.	$MgCl_2$.	NH_4Cl.	$FeCO_3$.	Total.
1487·7	31·36	0·033	0·204	1653·3

C. F. B.

Physiological Chemistry.

Permeability of Animal Membranes to Gases in Solution. By Leonard Hill and H. E. Ridewood (*Proc. Physiol. Soc.*, 1899, 13—19).—The lung of a frog or toad, with the bronchus tied, sunk in soda water by a weight, is soon filled out with carbonic anhydride, and rises with the weight to the surface; the gas is then discharged, and the lung sinks, when the phenomenon is repeated. This will go on for a week or more, and does not depend on the vitality of the lung, for a scalded lung acts as well. If the lung is first turned inside out, it does not occur, but in the case of skin, an inside-out bag blows out quickest; this does not happen with oxygen. India-rubber bags behave very similarly. Experiments with other gases are also described. W. D. H.

Comparative Physiology of Digestion. III. The Function of the so-called Liver of Molluscs. By WILHELM BIEDERMANN and P. MORITZ (*Pflüger's Archiv*, 1899, **75**, 1—86).—The observations recorded were made principally on snails. The structure of the digestive gland (so-called liver) shows various kinds of cells, "secretory cells" (Barfurth's ferment cells), which form a secretion which is poured into the stomach. The secretion is acid in reaction, lactic acid being present. It acts principally on carbohydrates, especially cellulose and starch, and thus contrasts forcibly with the secretion in caterpillars, which has no action on cellulose, and only a feeble action on starch. The snail's secretion has only a feeble action on proteids. The digestive gland acts like the liver of vertebrates, storing enormous quantities of carbohydrate material in the form of glycogen; this is contained in cells of the inter-acinous connective tissue, and also, especially in the *Limacidæ*, in certain liver cells, termed 'absorption cells,' and 'chalk cells.' Fat is also stored in considerable amount, especially in the "chalk cells." The so-called chalk is calcium phosphate, which is regarded as storage material.

The organ is also the great channel of absorption; little or no absorption occurs in the wall of the alimentary canal. W. D. H.

Structure of Cell Protoplasm. By W. B. HARDY (*Journ. Physiol.*, 1899, **24**, 155—210).—It is well known that various structures (net works, granules, &c.), have been described from time to time. The present paper is the first of a series in which the appearances alluded to are subjected to a rigorous investigation with the object of determining whether they are natural or artifically produced by hardening and staining reagents. The general conclusion drawn is that the change produced in colloids by fixatives is a separation of solid particles, which are large molecular aggregates; these are linked together by strands to form an open net with fluid in the meshes. The change produced in protoplasm is similar. The change which occurs in cells *post-mortem* or *sub-mortem* (coagulation) is of the same nature. W. D. H.

Glycogen in the Frog at Different Seasons. By J. ATHANASIU (*Pflüger's Archiv*, 1899, **74**, 561—569).—There is a small quantity of glycogen in the frog's body during the summer, and the amount is then at the minimum; the maximum occurs in the autumn, and the amount in the spring is also fairly high. By experimental warmth (summer temperature), a lessening of the total glycogen also occurs. The glycogen found at the conclusion of the winter sleep is merely the remainder of the stored material, very little of which would be used during hibernation. W. D. H.

Creatinine. By EMIL WÖRNER (*Zeit. physiol. Chem.*, 1899, **27**, 1—13).—Some fragmentary observations by the author confirm

Toppelius and Pommerehne's conclusions, and lead to the belief that Johnson's work on creatinine (Abstr., 1888, 506; 1889, 165; 1893, i, 55) is faulty; creatinine prepared from various sources appears to have the same characters; in other words, there are not several creatinines as Johnson stated. The amount of creatine in muscle is far in excess of creatinine as the older authors stated; this also is contrary to Johnson's statement. W. D. H.

Melanins. By WALTER JONES (*Amer. J. Physiol.*, 1899, **2**, 380—393).—A full account of experiments a preliminary notice of which has already been published (this vol., i, 396). W. D. H.

Toxalbumin from the Common Eel. By ELOPHE BÉNECH (*Compt. rend.*, 1899, **128**, 833—836).—The flesh of the common eel contains a toxalbumin, which, when injected into the vein of the ear of a rabbit, in the proportion of 0·02 gram per kilogram of body weight, causes paralysis, followed by death in about six hours, the blood being dark coloured and partially coagulated. It is precipitated by ammonium sulphate, but not by magnesium sulphate. Acetic, hydrochloric, sulphuric, and nitric acids produce a slight turbidity, soluble in excess, but alkalis have no action; alcohol produces an abundant coagulum. The substance gives the biuret reaction, and reactions with tannin, platinic chloride, and the reagents of Tanret, Esbach, Méhu, and Millon. It contains C, 50·18; H, 7·88; N, 16·1, and when dried is a yellowish-white powder with a disagreeable taste and an acrid after-taste. An eel of 600 grams weight yields from 2 to 2·5 grams of the toxalbumin. C. H. B.

Leucomaines of the Brain. By WL. GULEWITSCH (*Zeit. physiol. Chem.*, 1899, **27**, 50—82).—The fresh brain of the ox does not contain neurine; choline is found even in aqueous extracts, but by treatment of the alcoholic extract with sodium ethoxide, the quantity obtained is very largely increased. The aqueous extract of brain contains minute quantities of two other basic substances which have not been identified, and also urea in amount greater than can be accounted for by the blood left in the tissue. After saponification of the alcoholic extracts of the brain, the only organic base obtained was choline.

Regarding the separation of organic bases, much stress is laid on the solubilities of their double salts. W. D. H.

The Proteids of the Thyroid Gland. By AD. OSWALD (*Zeit. physiol. Chem.*, 1899, **27**, 14—49).—The principal proteid of the thyroid gland, the one to which the iodine is linked and to which extracts of the gland owe their action, is a globulin; it is called thyreoglobulin, and contains 1·6 per cent. of iodine. A nucleo-proteid is also present. The colloid consists of these two proteids.

In thyreoglobulin, artificial pancreatic digestion leads to the formation of tyrosine without any liberation of iodine; the iodine is therefore not united to the tyrosine group. By heating thyreoglobulin with 10 per cent. sulphuric acid, Baumann's iodothyrin was obtained; this is free from phosphorus. W. D. H.

Hæmatin from Blood and the Varieties derived from Various Species of Animal. By Paul Cazeneuve and P. Breteau (*Compt. rend.*, 1899, **128**, 678—680).—Defibrinated blood is heated to boiling with its own weight of sodium sulphate; the coagulum produced is washed with hot water, and triturated with a warm 1 per cent. alcoholic solution of oxalic acid, this treatment being repeated until the residue is decolorised. The filtered extract is almost neutralised with ammonia; the precipitated hæmatin, after collecting and washing with cold alcohol, is redissolved in dilute ammonia (5 per cent.), and again precipitated by acetic acid, washed with cold water, alcohol, and ether, and finally dried at 135°. By this process, 1 gram of hæmatin is obtained from a litre of blood. Specimens of hæmatin prepared in this way from the blood of the horse, ox, and sheep show differences in composition which indicate that they are distinct chemical species. G. T. M.

Motor Reactions and Laws of Chemotaxis in Paramœcium. By Herbert S. Jennings (*Amer. J. Physiol.*, 1899, **2**, 311—341, 355—379).—The sensibility of *Paramœcium* has been much over-estimated; it is at the bottom of the psychological scale, and simple irritability will account for all its movements. It has a single motor reaction to all stimuli; the direction in which it turns is a matter of chance. The motor reaction in chemotaxis does not differ from other motor reactions. The direction of motion has no relation to the part of the animal stimulated. *Paramœcia* collect in solutions having a weak acid reaction, or in solutions of salts in which the anion is especially active. Negative chemotaxis depends chiefly on the chemical nature of the stimulating substance, not on its injuriousness. Alkaline solutions, and those containing the kations of alkali or earth alkali metals, repel. The repellent power decreases as the atomic weight increases, except that potassium salts are throughout more repellent than sodium salts. W. D. H.

Absorption from the Peritoneal Cavity. By Lafayette B. Mendel *Amer. J. Physiol.*, 1899, **2**, 342—351).—A full account of experiments a preliminary notice of which has been previously published (this vol. ii, 309). W. D. H.

The Cause of the High Value of the C/N Quotient in Normal Urine. By Fritz Pregl (*Pflüger's Archiv*, 1899, **74**, 87—109).—The quotient C/N in the normal urine of men and dogs is greater than in urea; the urine must therefore contain some organic substance or substances which are poorer in nitrogen than is urea. The principal substance is believed to be the hydroxyproteic acid of Bondzyński and Gottlieb. W. D. H.

Excretion of Uric Acid. By Alexander Haig (*J. Physiol.*, 1899, **24**, 155—157).—Critical remarks on work recently published by Bain and Edgecombe, and by Hopkins and Hope. The main point urged is that correct conclusions cannot be drawn as to the excretion of uric acid unless means are taken to render that substance soluble in the body juices; otherwise it accumulates. W. D. H.

Action of Iodine and Iodine Compounds. By R. Heinz (*Virchow's Archiv*, 1899, **155**, 44—97).—Iodine injected into the serous cavities sets up an adhesive form of inflammation, necrosis of the tissues, and increased diapedesis of the blood corpuscles.

Of the chloride, bromide, and iodide of sodium, the last named is the most powerful. The chlorate, bromate, and iodate act as oxidising agents, but only the first-named produces methæmoglobin. Special attention was paid to the activity of sodium iodide; it produces an increase in the leucocytes, and of lymph-formation. Binz's theory that the action is mainly due to the liberation of iodine is accepted.

W. D. H.

Administration of Suprarenal Extract by the Mouth in Health and Disease. By O. F. F. Grünbaum (*Proc. Physiol. Soc.*, 1899, 24—25).—In health, administration of suprarenal tabloids by the mouth produces no rise of blood pressure, because the extract is not absorbed quickly enough; this renders it a good hæmostatic, especially in cases of hæmorrhage from the walls of the alimentary canal and bladder. W. D. H.

Intravenous Injection of Pituitary Extract. By Edward Albert Schäfer and Swale Vincent (*Proc. Physiol. Soc.*, 1899, 19—21).—The infundibular part of the pituitary contains substances, two in number, which produce effects on blood pressure. These substances dialyse through parchment paper, and are present in decoctions or glycerol extracts. One causes a constriction of arterioles and a rise of blood pressure; the other produces a fall of arterial pressure, which is not abolished by atropine. W. D. H.

Excretion of the Constituents of Urine in Fever. By Waclaw von Moraczewski (*Virchow's Archiv*, 1899, **155**, 11—43).—Numerous constituents of the urine were estimated in the several stages of different cases of fever, and the results are given in fullest detail. The general results are in the main confirmatory of earlier investigations. Some importance is attached to the observation that in an early stage of a fever the amount of chlorine in the urine rises, and that of phosphorus falls; the reverse occurs later on.

W. D. H.

Action of the Pancreas on the Diphtheric Toxin. By Albert Charrin and Levaditi (*Compt. rend.*, 1899, **128**, 839—841).—Experiments are described showing that the pancreas or its secretions exert a distinct attenuating influence on the diphtheric toxin, and that this effect is probably due to some diastatic action. C. H. B.

Fat in the Animal Body under the Influence of Phosphorus. By J. Athanasiu (*Pflüger's Archiv*, 1899, **74**, 511—560).—The absolute quantity of fat in the animal organism undergoes no change under the influence of phosphorus, but in phosphorus poisoning there is a migration of fat to the liver. The only substance which is quantitatively altered is glycogen, the amount of which is lessened, especially in the liver. W. D. H.

Chemistry of Vegetable Physiology and Agriculture.

Fermentation of Galactose. By DIENERT (*Compt. rend.*, 1899, **128**, 569—571).—When yeasts which are generally regarded as active in producing the fermentation of galactose are grown in different portions of the same nitrogenous culture fluid containing in one part (A) some saccharose, and in the other (B) some galactose, and the yeasts, after being washed, are placed in a 10 per cent. solution of galactose, it is found that the yeast B is much more active in producing fermentation than the yeast A. After each of them has once fermented a galactose solution, however, they become equal with respect to galactose, but show differences if put back into a solution of glucose. Conditions that promote propagation accelerate the rate at which the yeast becomes acclimatised, so to speak, in solutions of galactose. Some yeasts, such as *Saccharomyces Ludwigii*, do not appreciably ferment galactose, even when grown in a highly nitrogenous liquid containing glucose as well as galactose. Imperfect fermentation is produced when the proportion of yeast is very large. The fermentation of galactose requires conditions which are not necessary in the case of glucose (compare Dubourg, this vol., ii, 376). C. H. B.

Fermentation of Galactose. By DIENERT (*Compt. rend.*, 1899, **128**, 617—618).—A specimen of yeast, which does not ferment lactose, is cultivated in a nutritive medium in the presence of saccharose and lactose, and afterwards washed and placed in a 10 per cent. solution of galactose. The yeast is not acclimatised to galactose, and fermentation is set up only after 2—3 days. A similar result is obtained when the yeast is cultivated in the presence of saccharose alone. The same yeast, acclimatised to galactose, after cultivation in presence of an unfermentable sugar, lactose for example, partly loses its activity towards galactose, for when placed in a solution of this sugar it sets up fermentation, but only decomposes a portion of the carbohydrate. When cultivated in presence of a fermentable sugar, this loss of activity is not noticed. A yeast, such as *Saccharomyces Ludwigii*, which is only feebly active towards galactose, entirely loses this activity when macerated with a solution of lactose.

On the other hand, yeasts which ferment lactose, when cultivated in a medium containing this sugar, readily ferment galactose, but when macerated in a solution of saccharose, they lose this activity and only set up fermentation in solutions of galactose after 1—2 days. By treating the yeast in a manner similar to that employed by Hill (Trans., 1898, **73**, 634), an enzyme, lactase, may be isolated which hydrolyses lactose into glucose and galactose; this explains the fact that a yeast capable of fermenting lactose when cultivated in the presence of this sugar is already acclimatised to galactose.

G. T. M.

Stimulating Action of Pancreas on Alcoholic Fermentation. By RAPHAEL LÉPINE and MARTZ (*Compt. rend.*, 1899, **128**, 904—906). —Portions of the pancreas of the dog are digested for 5 minutes with boiling water to remove trypsin, and placed in flasks containing sugar, Pasteur's "mineral solution," and beer yeast. It is found that the addition of pancreas increases the amount of fermentation taking place in a given time; in each case, two experiments were made, one with normal pancreas, and the other with pancreas which had been recently excited by the electrical stimulation of the nerves surrounding the pancreatico-duodenal artery. The amount of fermentation is greater in the latter experiment, and the amount of carbonic anhydride produced for each gram of sugar destroyed is proportionately greater. This result is attributed to the peptones present in pancreas, and especially in the recently stimulated organ. Pancreas macerated for 30 minutes with water at 40° contains a large amount of peptones, and the accelerating effect on the fermentation attains a maximum, but when the maceration is prolonged for 2 hours at the same temperature, the action is greatly diminished. Concordant results can only be obtained with freshly excised pancreas in which trypsin has been destroyed in the manner indicated. G. T. M.

Molecular Relations of Solutions of Tetanus Poison. By W. G. Ruppel and F. Ransom (*Zeit. physiol. Chem.*, 1899, **27**, 109—113). —Nutritive fluids were investigated by the Raoult-Beckmann method, before and after the growth of tetanus bacilli in them. Those infected with the growth showed a greater depression of the freezing point. This must indicate an increase in the number of molecules. Some media, when kept for a long time, lost some of their toxic characters; the determination of the lowering of the freezing point indicated that molecular condensation accompanied this. The amount of solid residue throughout was practically unaltered. W. D. H.

Direct Conversion of Ammonia in Solution into Nitrates. By E. Demoussy (*Compt. rend.*, 1899, **128**, 566—599).—When a solution containing ammonium sulphate, calcium carbonate, and potassium phosphate is inoculated with soil containing the nitrous and nitric ferments, the ammonia is converted into nitrate, but the intermediate formation of nitrite is readily detected. If, however, the nitric ferment is first cultivated in a solution of potassium nitrite, calcium carbonate, and potassium phosphate, and then an ammonium salt is added to the liquid, the ammonia is completely and somewhat rapidly converted into nitrate, but the intermediate formation of nitrite cannot be recognised at any stage. It would seem, therefore, that the impossibility of detecting nitrites in soils in which nitrification is going on is due to the fact that the rates of production of nitrite and of its conversion into nitrate are equal. This conversion is made possible by the slow rate of production of ammonia from the organic matter in the soil and the consequent slow production of nitrite, whilst, on the other hand, the quantity of nitric ferment present is large. In liquids containing ammonia salts, the production of nitrites is rapid and the number of nitric organisms present is proportionately much smaller than in soils. C. H. B.

Reducing Action of Denitrifying Bacteria. By G. Ampola and C. Ulpiani (*Gazzetta*, 1899, **29**, i, 49—72. Compare Abstr., 1898, ii, 622).—Denitrifying bacteria do not attack asparagine or nitromethane, and with ethylic nitrate the action is very slow. From this, it is concluded that denitrification only takes place with oxygen compounds of nitrogen, and only with such of these as are electrolytes, and are thus dissociated into ions in solution.

From the results of a number of experiments, the authors find it necessary to modify Weissenberg's classification of denitrifying bacteria, and to arrange them under three heads: 1. Those which destroy nitrites but not nitrates, namely, *Bacterium denitrificans I.* of Burri and Stutzer. 2. Those destroying nitrates but not nitrites—*Bacillus pyocyaneus* and *Bacterium denitrificans V.* 3. All other denitrifying bacteria, which attack both nitrites and nitrates.

The qualitative and quantitative examination of the action of *B. denitrificans V.* on a number of metallic nitrates show that those of lithium, ammonium, sodium, potassium, rubidium, cæsium, beryllium, magnesium, calcium, strontium, and barium are denitrified, whilst the nitrates of silver, thorium, yttrium, iron, manganese, and aluminium are not attacked; and that the more electropositive the metal and the lower its atomic weight, the more rapidly does denitrification take place. Carbamide nitrate, which is only slightly dissociated in solution, is slowly attacked, whilst with the nitrates of strychnine, brucine, cocaine, and pilocarpine, which are entirely ionised in solution, denitrification is soon complete. The bacteria do not develop in metallic chromates, and only to a small extent in bromates or iodates; chlorates, arsenates, and ferricyanides suffer reduction, but sulphates, phosphates, and molybdates remain unchanged. T. H. P.

An Oxydase secreted by Bacillus Coli which can produce Pigments. By Gabriel Roux (*Compt. rend.*, 1899, **128**, 693—695).—*Bacillus coli* cultivated on artichoke gives rise to an intense green coloration. Laccase develops an olive-green coloration with a decoction of artichokes. When *B. coli* is cultivated in a medium containing quinol, a brown coloration is developed. These experiments indicate that *B. coli* secretes an oxydase which produces colorations in the presence of easily oxidisable substances. G. T. M.

Dextrin considered as Reserve Material. By Leclerc du Sablon (*Compt. rend.*, 1899, **128**, 944—945).—The quantity of starch in the hyacinth bulb during the stage of growth (January to March) is relatively small. It attains a maximum in the quiescent stage (May), and falls to a minimum when the reserve material is being utilised (November to February). If dextrin is an intermediate product in the formation of starch, it should be found in the bulb during the growing stage; if it is also a result of the assimilation of starch, it should still be found when the reserves are being utilised; this is shown to be the case, but the maximum amount of dextrin is present during the quiescent stage, hence it appears to play the part of a reserve material quite independently of starch. This conclusion is borne out by a study of the reserve materials in the bulbs of the tulip and lily, both of which contain the maximum amount of dextrin during the resting stage. G. T. M.

Sugar of Orange Peel. By Julian Flatau and Henri Labbé (*Bull. Soc. Chim.*, 1898, [iii], **19**, 408).—When fresh orange peel is extracted with water or alcohol, a small quantity of a gummy, uncrystallisable sugar is obtained, which appears to be identical with mannose, since it forms a phenylhydrazone crystallising in golden-yellow needles and melting at 199—200°, is precipitated by lead acetate in neutral solution, and does not restore the colour of rosaniline decolorised by sulphurous acid. N. L.

Progressive Development of Grape Clusters. By Aimé Girard and Lindet (*Bull. Soc. Chim.*, 1898, [iii], **19**, 585—588).—This is a *résumé* of a memoir shortly to be published in the *Bulletin du ministère de l'Agriculture.* A series of analyses of three varieties of French grapes was made at various stages of growth. The weight of the stalks is found to be nearly constant throughout, the only changes in composition noted being a slight loss of moisture as ripening proceeds and an occasional accumulation of sugars and acids in their passage through the vessels. The increase in weight of the grape during maturation is due to the growth of the pulp alone, the skin remaining constant, and the seeds suffering a diminution in weight. With regard to the pulp, the process of ripening is marked by a gradual increase in the sugars (consisting of equal quantities of lævulose and dextrose, probably accompanied by cane sugar in the early stages) and in the combined tartaric acid, a decrease in the amount of free acids, which include tartaric, malic, and glycollic acids, and a large increase in the nitrogenous and mineral constituents, especially in the later stages. At the commencement of growth, the zone of pulp surrounding the seeds is richer in sugar and poorer in acids than the exterior portions, but as ripening proceeds this condition is reversed. Notwithstanding its increase in size, the weight of the skin is practically constant; water, however, is lost, and new materials are assimilated. The combined tartaric acid first increases and then rapidly diminishes; the free acids tend to disappear before ripening; and the tannin, which is accompanied by its anhydride phlobaphen, first increases and then remains constant in amount. The odorous matter, to which the bouquet is due, is developed in the later stages of growth. The amount of cellulose, nitrogenous substances, and mineral matter contained in the seeds remains constant almost throughout. The same applies to the combined weight of the tannin and phlobaphen, although the relative proportions of these two compounds vary considerably. The gradual decrease in weight of the seeds is due to loss of water and of oil. In the last stages of ripening, there is a more abundant formation of volatile fatty acids, which exist partly in the free state and partly as glycerides, and at the same time a corresponding decrease in the nitrogenous substances, mineral matter, and cellulose. N. L.

Phlobaphen of the Grape. By Aimé Girard and Lindet (*Bull. Soc. Chim.*, 1898, [iii], **19**, 583—584).—Further study of the bitter, resinous substance shown by the authors (*Bulletin du ministère de l'Agriculture*, 1895, 694) to be present in the stalk, skin, and stones of the grape has established its identity with phlobaphen, which Etti (Abstr., 1878, 797; 1883, 995) obtained from oak bark and from hops, and considered to be an anhydride of tannin of the composition $C_{34}H_{30}O_{17}$. On boiling the acid solution of the stalks or stones from which the phlobaphen has been isolated, a red substance is deposited which closely resembles phlobaphen in composition and properties, and is similar to the insoluble red compounds usually found in association with tannin; the formation of reducing sugars under these conditions was not observed. Estimations of the tannin and phlobaphen in grape stalks show that the sum of the amounts of the two compounds is constant, a decrease in the one being compensated for by an increase in the other, and it is suggested that phlobaphen is the reserve material in which tannin is stored in the plant. N. L.

A Phlobaphen from Grape Seeds. By Livio Sostegni (*Gazzetta*, 1899, **29**, i, 143—149. Compare Abstr., 1898, i, 331).—The seeds of red grapes were washed with water, dried in the air, and kept in a dry place for about a year. On digesting with water at 50—60° and adding hydrochloric acid, a yellowish substance was precipitated which, in the moist state, is very soluble in alcohol, less so in water, and is only slightly dissolved by ether. The aqueous solution gives with iron salts a bluish-green precipitate, and is coloured brown by potassium dichromate; salts of copper, lead, zinc, &c., also precipitate it, the zinc compound being soluble in acetic acid, but insoluble in ammonia. On drying in the air, this substance gradually acquires a brownish colour, becomes absolutely insoluble in all ordinary solvents, and acquires all the properties of the phlobaphen obtained by the author from red wine (*loc. cit.*). It can, however, be re-dissolved in hot glycerol, from which dilute hydrochloric acid precipitates it in a form almost insoluble in water, but soluble in alcohol, giving a deep ruby-red solution.

Solutions of this reprecipitated substance show an absorption band beginning at about the D lines and extending over the rest of the spectrum to the violet. The mean of two determinations give its percentage of carbon as 58·55, and of hydrogen 4·98. On fusion with potash, it yields phenol, catechol, and possibly phloroglucinol. Its copper compound contains 29·48 per cent. of metal, and its silver salt 50·92 per cent. It forms a brominated derivative containing 41·2 per cent. of halogen. The addition of alcoholic potash to an alcoholic solution of the substance precipitates a dark brown substance which is very soluble in water and absorbs oxygen from the air very rapidly.

From all these reactions, the author concludes that the substance obtained from grape seeds is identical with the colouring matter of the grape itself. T. H. P.

Mercury in the Products from Vines treated with Mercurial Dressings. By Léo Vignon and J. Perraud (*Compt. rend.*, 1899, **128**, 830—832).—When vines have been dressed with mixtures of copper sulphate, lime, and mercuric chloride in proportion not exceeding 1 gram per litre, the quantity of mercury found in the wine, lees, or other products does not exceed 2 or 3 milligrams per litre or per kilo., and is generally much less, besides being mainly in an insoluble form. It follows that it is not at all likely to be injurious.

On the other hand, the application of the mercurial dressing is found to be distinctly injurious to the plant. C. H. B.

Analyses of Pomegranates. By ARTHUR BORNTRÄGER and G. PARIS (*Bied. Centr.*, 1899, **28**, 198—200; from *Zeits. Unters. Nahrungs- u. Genussmittel*, 1898, 158).—Analyses of the expressed juice of six kinds of pomegranates showed that in the case of ripe fruit the juice contained 0·37—0·51 gram of acid and 10·50—13·69 grams of reducing sugar per 100 c.c., whilst unripe fruit contained acid 3·04 and 3·36, reducing sugar 7·81 and 11·33 per cent. The musts were normally fermented, and an orange-red wine obtained resembling raspberries in taste. Even the ripe fruit contains so little sugar that only wines can be obtained which contain low percentages of alcohol. The amounts of alcohol actually found in three samples were 4·37, 5·72, and 6·99 grams per 100 c.c. N. H. J. M.

Currant Bushes failing to bear Fruit. Investigation into the Cause—Analyses of the Soil. By ANDREW P. AITKEN (*Trans. Highland and Agric. Soc. of Scotland*, 1898, [v], **10**, 293—299).—In an orchard near Glasgow it was observed during four seasons that whilst the currant bushes seemed healthy and flowered abundantly, the flowers soon dropped off, with the result that no fruit was produced. Analyses of the soil showed that the soil and subsoil contained fair amounts of nitrogen and phosphoric acid, but were poor in potash and lime. Application of large amounts of lime and potash had, however, no effect. It is concluded that the injury is due to some substance present in the air during the flowering period.

Comparison of the soil of the orchard, which had been heavily dunged, with that of the adjacent arable land showed less difference in the percentages of organic matter and nitrogen than might be expected. In the amounts of available potash and phosphoric acid, however, great differences were found, the available potash being increased three-fold and the amount of available phosphoric acid being doubled in the first six inches of soil under the influence of farmyard manure. The total potash and phosphoric acid were not greatly increased. N. H. J. M.

Amount of Lignin in the Wood of Trees with Acicular Leaves. By ADOLF CIESLAR (*Bied. Centr.*, 1899, **28**, 250—251; from *Mitt. forstl. Versuchsw. Oesterr.*, 1897, Heft. 23).—Estimations of lignin by Zeisel's methoxyl method (Benedikt and Bamberger) furnished results from which the following conclusions are drawn.

The amount of lignin in the single species varies more than in the case of different coniferous woods. Of the woods examined, that of spruce fir contained the least lignin (39·10 per cent.); that of silver fir the most (45·50 per cent.); whilst pine wood contained 43·81 per cent. In pine wood, the amount of lignin decreases from the base upwards, and the old wood contains more lignin than the newer wood.

Wood which has grown quickly contains less lignin, in a given volume, than wood which has grown slowly. The conditions favourable to the production of lignin are presence of suitable plant-food and abundance of light. N. H. J. M

Feeding Experiments, 1897. By **Andrew P. Aitken** (*Trans. Highland and Agric. Soc. of Scotland*, 1898, [v], **10**, 259—292). —*Cattle fed at Mains of Laithers* (compare *ibid.*, 1897, 156—180). —The experiments, which were similar to those of 1896, and extended over 16 weeks, were made with 50 cattle, divided into five lots of five pairs; they were weighed every four weeks. Each pair received swedes (17,920 lbs.) and straw, and, in addition, those of Lot 1 had 1492 lbs. of decorticated cotton-cake and dried grains (mixed); those of Lot 2, linseed cake meal (1120 lbs.); those of Lot 3, barley bran (1680 lbs.); Lot 4, ground barley (1232 lbs.), and Lot 5, ground maize (1491 lbs.). The amounts actually consumed and the increase in live weight of each pair are given in tables. The greatest increase was obtained in Lots 1 and 2, which (if one bullock which made no progress is excluded) were about equal; Lots 3 and 5 consumed about the same amounts of digestible organic matter (Lot 3 had, however, the most proteids) and made equal progress, although Lot 3 were fat before the end of the experiment, whilst Lot 5, which had grown, required two months longer. Lot 4 gave much the least satisfactory results. The results show that the nutritive ratio of a food (especially of a mixed food) is a very imperfect guide, and also illustrate the difficulties which arise from the individual characters of cattle as feeders, even when a considerable number are employed in experiments of this kind.

Sheep-feeding Experiments at Ferney Castle and Whitelaw.—Four lots of 20 sheep each were fed at each farm during about 12 weeks on turnips (*ad lib.*), with 1 lb. per head per day of (1) decorticated cotton-cake and dried brewers' grains (equal parts); (2) linseed cake; (3) bruised oats and barley (equal parts); and (4) bruised oats and maize (equal parts).

The results showed that there is very little difference in the effect of linseed cake and a mixture of cotton cake and brewers' grains when consumed with turnips. Oats and maize proved to be slightly better than oats and barley, both mixtures being much inferior to cake; and the more highly nitrogenous food is more favourable to wool production. In both farms, most tallow was produced under the influence of the oats and maize mixture; this had also been observed in a former experiment. N. H. J. M.

Maize Oilcake for Milch Cows. By **Bernhard Schulze** (*Bied. Centr.*, 1899, **28**, 165—167; from *Fühling's Landw. Zeit.*, 1898, ii, 12).—The average percentage composition of maize oilcake was found to be as follows:

Water.	Proteids.	Fat.	N-free extract.	Crude fibre.	Ash.
10·28	19·46—26·91	8·10—16·18	38·97—43·10	10·26	2·37

Feeding experiments with twelve cows showed a slight increase in the yield of milk with 2—4 lbs. of the cake, but the percentage of milk-fat was diminished. The cows, however, gained in weight, and it is probable that the cake may be employed with advantage for fattening. N. H. J. M.

Carbon in Humic Substances. By Gustave André (*Compt. rend.*, 1899, **128**, 513—516).—The author has continued his researches (this vol., ii, 119) with special reference to the relation between carbon and nitrogen. The results are summarised in the following table, I being the ratio C/N, II carbon per cent. of the initial carbon.

	Peat.		Cultivated soil.		Moorland soil.		Vegetable mould.	
	I.	II.	I.	II.	I.	II.	I.	II.
Treatment with potassium hydroxide.								
Insoluble portion..........	147·6	24·5	84·4	40·0	82·4	35·4	40·4	41·8
Soluble portion { precipitated by acids	26·9	44·8	16·6	23·0	27·1	36·6	10·8	18·7
Soluble portion { not precipitated by acids.......	17·7	30·7	9·8	37·0	16·7	28·0	10·1	39·5
Treatment with acid.								
Soluble portion	40·7	82·2	33·6	76·3	48·8	75·6	17·7	82·6
Insoluble portion..........	9·4	17·8	6·6	23·7	11·9	24·4	8·5	17·4

Peat and moorland soil, which are acid soils, differ markedly from cultivated soil and vegetable mould in the composition of the soluble products of the action of potassium hydroxide. Hydrochloric acid breaks down the organic matter less readily than potassium hydroxide. In both cases, the ratio C/N is lower and the degree of condensation is less the more soluble the product. Cultivated soil and vegetable mould, with either alkali or acid, yield soluble products which have the composition of simple amides. C. H. B.

Action of very Dilute Acids on Phosphates of the Soil. By Th. Schlœsing, jun. (*Compt. rend.*, 1899, 1004—1007).—If specimens of a soil containing phosphates are treated with very dilute nitric acid, it is found that, up to a certain point, the amount of phosphate dissolved varies with the concentration of the acid. Beyond this, a further addition of acid does not increase the amount of phosphate in solution, and it is only when the concentration is considerably increased that the quantity of soluble phosphate is appreciably augmented. The phosphates of calcium, magnesium, and the alkali metals are dissolved out during the first stage, and the extract contains only traces of iron; in the second stage, however, the solution contains a notable amount of iron. These experiments were made on soils from four different localities, and the results are tabulated so as to indicate the relationship between the strength of acid employed, the final acidity of the extract, and the amounts of phosphoric acid and ferric oxide which have passed into solution.

G. T. M.

Explanation of Denitrification and of the Diminution of Crops after the Application of Fresh Farmyard Manure. By W. Krüger and W. Schneidewind (*Bied. Centr.*, 1899, **28**, 154—156; from *Deut. Landw. Presse*, 1897, No. 92, 832).—From the results of two series of pot experiments, it was concluded that the diminished yield following manuring with fæces and straw depends on a purely mechanical action, or else that the solid substance influences the microbes in the soil by increasing the porosity of the soil, or by supplying nutritive matter. Further experiments in the laboratory showed that the action is physiological, and not mechanical, and is due mainly to the presence of xylan in the straw. It is probable that denitrification can only take place in presence of xylan or similar substances. The introduction of denitrifying organisms by application of manure containing straw is not of importance, since the microbes are already in the soil in sufficient numbers, and may also be introduced along with seed, or from the air. Their activity, however, depends on the presence of suitable nutritive matter.

THEODOR PFEIFFER (*Deut. Landw. Presse*, 1897, 911) considers the above conclusions premature, and that whilst it is recognised that straw and fæces act as sources of food for denitrifying organisms rather than as carriers of the microbes, it is doubtful whether xylan is a good source of carbon for them. N. H. J. M.

Analytical Chemistry.

An Automatic Burette. By HENRY DROOP RICHMOND (*Analyst*, 1899, **24**, 2—4).—This burette is intended for the delivery of strong sulphuric acid. The lower end is fitted with a three-way tap which is connected with the stock bottle by means of a siphon and the usual air-trap, which enables an india-rubber connection to be used.

The burette is closed by a cork, fitted with a very narrow tube which reaches to the zero point and the protruding part of which rises nearly to the top of an air chamber, the lower part of which is connected with a narrow ascending tube made to dip into a small funnel passing through the cork of the stock bottle.

When the burette wants filling, the tap is turned half-round. The liquid then siphons over from the stock bottle, fills the burette to the zero division, and, running over into the air chamber, ascends the tube until its level is equal to that of the stock bottle. When the liquid is run out from the burette, air is drawn down the ascending tube and bubbles through the liquid in the air chamber, and when the burette is refilled the acid in the air chamber is forced back into the stock bottle.

L. DE K.

Automatic Burettes. By ALFRED W. STOKES (*Analyst*, 1899, **24**, 4—6).—Two automatic burettes are described, of which the more accurate form consists essentially of a measuring vessel having a lateral opening at the top and another at the bottom. The lower end, connected with the supply, revolves in a sleeve, and the upper end, connected with the overflow, revolves in another. The instant the vessel is revolved, all connection with the reservoir and overflow is cut off, so that the measure contains an absolutely exact quantity of liquid. Half a revolution brings the lower opening to the exit tube, and its upper opening to an air inlet. L. DE K.

Rapid Estimation of Small Quantities of Free Phosphorus in Phosphorus Paste. By LESTER REED (*Analyst*, 1899, **24**, 33).—A weighed quantity of yellow phosphorus is dissolved in 20 c.c. of carbon bisulphide, and introduced into a bottle containing 1 c.c. of the usual paste (flour, glucose, and water), 5 c.c. of absolute alcohol added, and the whole shaken until the paste is disintegrated. A solution of bromine in carbon disulphide (5 or 10 grams in 50 c.c.) is now added from a burette until a decided yellow colour is obtained in the supernatant liquid.

A weighed quantity of the phosphorus paste is then mixed with 5 c.c. of absolute alcohol, shaken until thoroughly disintegrated, 20 c.c. of carbon bisulphide added, and the titration with the bromine solution conducted as before. The method of calculation is obvious. Part of the phosphorus may have been oxidised to phosphorous acid which also absorbs bromine; its amount is ascertained by extracting the paste with proof spirit and titrating the filtrate. L. DE K.

Composition of Ammonium Magnesium Phosphate. By FRANK A. GOOCH and MARTHA AUSTIN (*Zeit. anorg. Chem.*, 1899, **20**, 121—136).—When a magnesium salt is precipitated with excess of phosphate solution in the presence of ammonia and ammonium chloride, the precipitate contains more ammonium and less magnesium than the normal salt, and on ignition leaves a residue greater in weight than the normal phosphate. Conversely, when a phosphate is precipitated with excess of magnesia mixture in the presence of ammonia and ammonium chloride, a precipitate of similar composition is obtained, causing a low result for the analysis. The salt which is formed to some extent is probably $(NH_4)_4Mg(PO_4)_2$, which, on ignition, yields the metaphosphate $Mg(PO_3)_2$, and if the excess in weight of precipitate obtained by precipitating a magnesium salt in the ordinary way with excess of phosphate in the presence of ammonia and ammonium chloride is calculated out on this assumption it sometimes corresponds with 10 per cent. of metaphosphate. The results of a large series of precipitations under various conditions are given. Accurate results are obtained in the estimation of magnesium and phosphoric acid, when the precipitate obtained in the ordinary way is allowed to settle, separated from the excess of precipitant by decantation, redissolved in hydrochloric acid, again precipitated with a slight excess of ammonia, and washed with dilute ammonia. Accurate results are also obtained by adding a slight excess of magnesia mixture to the solution of phosphate, which must not contain more than 5—10 per cent. of ammonium chloride, and then adding a slight excess of ammonia. When more ammonium chloride is present, or when more than double the theoretical quantity of magnesia mixture is employed, it is necessary to redissolve the precipitate and again precipitate with a slight excess of ammonia.

E. C. R.

Estimation of Carbonic Oxide. By ARMAND GAUTIER (*Compt. rend.*, 1899, **128**, 487—488).—A question of priority. C. H. B.

Analysis of Sediment deposited during Electrolytic Refining of Copper. By AUGUSTE HOLLARD (*Bull. Soc. Chim.*, 1898, **19**, [iii], 470—472).—This sediment contains notable amounts of gold, silver, and copper. The gold is estimated by fusing the dried sediment with a mixture of litharge, nitre, sodium carbonate, and borax, a further quantity of litharge and a small amount of carbon being added towards the end of the operation; the lead button produced is cupelled and the resulting silver-gold alloy parted with nitric acid. Another portion of the dried sediment is heated in a current of chlorine until the volatile chlorides of arsenic, antimony, &c., are removed; the residual chlorides are lixiviated with dilute nitric acid, the copper in the filtrate and the silver in the precipitate (the latter after treatment with potassium cyanide) being estimated electrolytically. G. T. M.

Estimation of Copper and Mercury in Grapes, Wines, Lees, and Marcs. By LÉO VIGNON and BARRILLOT (*Compt. rend.*, 1899, **128**, 613—615).—Solutions of copper and mercury salts are employed as remedies in parasitic diseases of the vine, and traces of these metals are accordingly found in grapes and wine. The wine is filtered, and the lees are extracted with water and cold dilute aqua regia; grapes and husks are also submitted to the latter treatment. The solutions obtained in this way are treated with hydrogen sulphide, the precipitated sulphides digested with hot nitric acid, and the mixture filtered. The copper in the solution is estimated electrolytically, and the mercury in the residue is determined by the authors' colorimetric method (Abstr., 1893, ii, 345). G. T. M.

Volumetric Estimation of Nickel. By GIOVANNI GIORGIS (*Gazzetta*, 1899, **29**, i, 72—80.)—Gibbs' method of estimating nickel, namely, precipitating with an alcoholic solution of oxalic acid of known strength, and by means of permanganate determining either the oxalic acid left in the filtrate, or that contained in the precipitate, is inaccurate, owing, firstly, to the partial solubility of the nickel oxalate, and, secondly, to the fact that the removal of the alcohol from the liquid cannot be completely effected without decomposing some of the oxalic acid. To remove these objections, the author has devised an improved process, which consists in using as precipitant an oxalic acid solution of either barium or strontium oxalate of known strength. No addition of alcohol is necessary, for on boiling the liquid the nickel is thrown down quantitatively as oxalate. The oxalic acid in the filtrate may then be estimated by titrating an aliquot part with permanganate, or that in the precipitate by treating it with a little sodium carbonate or hydroxide, acidifying with sulphuric acid, and titrating with permanganate. Test analyses of nickel sulphate solutions and of nickeliferous steels show that the method gives good results. T. H. P.

Estimation of the Amount of Softening Agent required for Hard Water. By LEO VIGNON and MEUNIER (*Compt. rend.*, 1899, **128**, 683—686).—Carbonic anhydride in water, whether free or combined as hydrogen carbonate, is readily estimated by titrating the water with standard calcium hydroxide solution mixed with an equal volume of alcohol containing phenolphthalein (compare Abstr., 1888, 325). From this analysis, the amount of lime required to remove the temporary hardness is readily calculated. The amount of sodium carbonate required to remove the chlorides and sulphates of calcium and magnesium is obtained in a similar manner; the water is titrated with a standard solution of this reagent, an equal volume of alcohol being added to render the precipitation of calcium and magnesium carbonates complete; the indicator employed is phenolphthalein. G. T. M.

Technical Analysis and Softening of Water for Boilers. By GIOVANNI GIORGIS and G. FELICIANI (*Gazzetta*, 1899, **29**, i, 152—167).—The authors give two volumetric methods for determining the total and permanent hardness of water. In the first, a certain volume of the water is acidified with acetic acid, boiled to expel carbonic anhydride, and neutralised with caustic soda; a known volume of standard sodium phosphate solution is then added, the solution boiled for some minutes, and sodium hydroxide added drop by drop until the liquid is just alkaline. By this means, the lime and magnesia are precipitated as neutral phosphates, and by determining the excess of sodium phosphate added the amounts of lime and magnesia in the water can be calculated.

The other method is a modification of that given by Knöfler (Abstr., 1886, 180). The water is acidified with hydrochloric acid, boiled, and carefully neutralised with sodium hydroxide solution; a known volume of decinormal soda is then added, the solution boiled, decinormal sodium carbonate added, and the boiling continued for some minutes. On cooling, the excess of alkali in an aliquot part of the liquid is determined by titration with decinormal hydrochloric acid. The hardness of the water is calculated from the quantity of sodium hydroxide and carbonate required to precipitate the lime and magnesia. These methods have been tested and found to give good results.

For the softening of water, the authors recommend the combined use of lime and sodium carbonate, and show how, in this way, the calculation of the requisite quantities to be added to any particular water, as given by Kalman's formula, is simplified. The lime is first weighed out and slaked with a small quantity of the water to be softened; when completely slaked, it is added to the remainder of the water, to which after some time the proper quantity of a standard solution of sodium carbonate is added. T. H. P.

Detection of Saw-dust in Flour. By A. LE-ROY (*Bull. Soc. Chim.*, 1898, **19**, [iii], 478).—The detection of saw-dust in inferior qualities of wheat flour and in oat and barley flour is rendered difficult from the fact that these flours, when unadulterated, contain a certain amount of cellulose (bran) derived from the grain. An intense, crimson-red coloration is developed in the particles of saw-dust when the adulterated flour is treated with a warm alcoholic solution of phloroglucinol containing phosphoric acid; the colour produced in the particles of bran is negligible in comparison. When the alcoholic solution is acidified with hydrochloric acid, the action appears more energetic, but the contrast between the behaviour of the two forms of cellulose is less striking. The saw-dust from deal, birch, oak, and cherrywood develops this coloration, that from corozo does not. An approximate determination of the amount of adulterant is obtained by using a pure flour, gradually adding known quantities of saw-dust, and matching the coloration developed by phloroglucinol with that of the adulterated specimen. G. T. M.

Estimation of Phenol in Urine. By Carl Neuberg (*Zeit. physiol. Chem.*, 1899, **27**, 123—134).—The method of estimating phenol introduced by Kossler and Penny (Abstr., 1893, ii, 100) was examined, and certain disadvantages are pointed out. It gives too high results in the presence of dextrose. Some modifications are suggested. W. D. H.

New Test for Formaldehyde. By Norman Leonard and Harry M. Smith (*Analyst*, 1899, **24**, 86).—The violet coloration occasionally observed when milk is heated with strong hydrochloric acid can form a very delicate reaction for proving the presence of formaldehyde. The sample should be heated with about 5 times its volume of hydrochloric acid, which must contain a minute trace of iron, when in the case of milks containing such quantities of formaldehyde as are commonly added a fine violet colour quickly appears, even if the milk contains only 1 part per million of the preservative. If much over 0·1 per cent. of formaldehyde is present, a yellow coloration is obtained, but this will change to violet on addition of a large excess of hydrochloric acid. It is safer to work in the cold, but the coloration then takes a longer time to develop. L. de K.

A Delicate Test for Acetonedicarboxylic Acid. By Georges Denigès (*Compt. rend.*, 1899, **128**, 680—682).—This acid, like other aliphatic ketones, forms a compound with mercuric sulphate. This substance has the formula $Hg_3SO_6,2CO(CH_2\cdot COO)_2Hg$, and is obtained as a white precipitate when excess of mercuric sulphate solution is added to a solution of acetonedicarboxylic acid; its formation is readily observed even when the ketonic acid is present only in traces, and may be employed to detect as little as 1 milligram of this substance per litre. The time which elapses between the addition of the reagent and the appearance of the turbidity is also an indication of the quantity of acetonedicarboxylic acid present in the solution, and a table is given showing the connection between the interval of time and the quantity of the acid in centigrams per litre. G. T. M.

Estimation of Malic Acid in Grapes. By Aimé Girard and Lindet (*Bull. Soc. Chim.*, 1898, [iii], **19**, 585).—After removal of the free and combined tartaric acid by addition of alcohol and ether and precipitation with potash, according to Berthelot and Fleurieu's process, the liquid is evaporated to remove alcohol and ether, the residue dissolved in water, the solution boiled, and normal lead acetate added until a slight opalescence is produced. The solution is filtered while hot, and the lead malate, which crystallises on cooling, is collected, dried, and weighed. Further quantities of lead malate are obtained by repeated treatment of the mother liquor, the acidity of which is finally determined, and a correction applied for the lead malate remaining in solution, according to the table given below:

Free acetic acid per 100 c.c. mother liquor....	0·21	0·40	0·55	0·73	0·90
Lead malate dissolved in 100 c.c. mother liquor ...	0·10	0·13	0·16	0·18	0·20

N. L.

Analysis of Gallotannic Acids. By ADOLF HEINEMANN (*Zeit. angw. Chem.*, 1899, 245—253).—An elaborate investigation of the merits of the gravimetric and volumetric methods for the estimation of tannin.

The conclusions arrived at are that, either from a scientific or a technical point of view, the gravimetric method should be accepted and the volumetric one rejected. The first, as is well known, consists in evaporating a portion of the infusion and weighing the residue; this operation is then repeated after removing the tannins by means of hide-powder. But even this process gives untrustworthy results unless worked under strictly comparable conditions; the author now proposes the following modification: To 100 c.c. of the solution, which should contain from 1—1·5 grams of tannins, 3 grams of prepared hide-powder is added, and the mixture left for 14—16 hours, being shaken frequently. The liquid is then filtered through paper, and should not give a precipitate either with gelatin solution (1 gram of gelatin, 100 c.c. of water, and 1 c.c. of phenol), or with tannin; a definite portion is then evaporated to dryness, and the weight of the non-tannin solids thus obtained deducted from that of the residue left by the infusion before treatment with hide-powder.

The hide-powder is prepared as follows: The commercial product is treated 8 times with 20 times its bulk of water, thrown on a cloth filter, and well pressed; it is then treated with 10 times its amount of alcohol, again collected and pressed, then dried at 100°, and powdered. It will then be in excellent condition, and contain about 7 per cent. of moisture.

The author has tried the "silk process" recommended by Vignon (this vol., ii, 135), but considers it less satisfactory than the hide-powder method. L. DE K.

Testing of Oil and Spirit of Mustard. By JOHANNES GADAMER (*Arch. Pharm.*, 1899, **237**, 110—111).—The following method is recommended in place of that prescribed by the German Pharmacopœia. Oil of mustard is first converted into spirit of mustard by diluting 2 grams of it with 98 grams of spirit of wine. Of the spirit of mustard, 5 c.c. (= 4·2 grams) are allowed to remain with 25 c.c. of *N*/10 silver nitrate solution and 5 c.c. of ammonia for 24 hours in a well stoppered flask of 50 c.c. capacity, diluted to the mark, and filtered from precipitated silver sulphide; 25 c.c. of the filtrate are mixed with 4 c.c. of nitric acid and a few drops of ferric sulphate solution, and titrated with *N*/10 ammonium thiocyanate solution; of this, 4·1—4·5 c.c. should be required (corresponding to about 1·852—2·000 per cent. of allylthiocarbimide in the spirit, 92·6 to 100 per cent. in the oil).

C. F. B.

Preparation and Testing of "Spiritus Cochleariæ." By Johannes Gadamer (*Arch. Pharm.*, 1899, **239**, 105—110).—The method of preparation prescribed by the German Pharmacopœia, namely, to distil the green, crushed scurvy-grass with alcohol and water, is unsuitable. In the first place, the immediate addition of alcohol prevents the due action of the ferment, by means of which the thiocarbimide is probably formed from some glucoside, and, in the second place, the green plant is available only during a very limited season of the year; nor can the artificial oil of scurvy-grass be employed, for it (at least that supplied by Schimmel and Co.) is isobutylthiocarbimide, whereas the natural oil is secondary butylthiocarbimide. A normally prepared spirit contains 0·06—0·07 per cent. of secondary butylthiocarbimide, and may be prepared suitably from the dry plant in the following manner: Dried scurvy-grass (4 parts) and coarsely powdered white mustard (1 part) are allowed to remain with water (40 parts) for 3 hours in a glass retort; spirit of wine (15 parts) is then added, and 20 parts are distilled over. (The dried scurvy-grass does not contain the ferment present in the green plant; the mustard is intended as a substitute for it.) The distillate is a clear, colourless, feebly dextrorotatory liquid with a peculiar odour and penetrating, burning taste; it has a sp. gr. 0·908—0·918.

The purity of the spirit may be tested by heating 50 grams with 5 c.c. ammonia for a few hours on the water-bath in a flask furnished with an air condenser, evaporating to dryness, extracting the residue with a little alcohol, and allowing the filtered alcoholic extract to evaporate on a watch glass; the melting point of the crystals should lie between 125° and 135°. (Pure secondary butylthiocarbamide, 136—137°. The thiocarbamides derived from the probable adulterants are those of allyl, melting at 72—74°; normal butyl, 79°; isobutyl, 93·5°; tertiary butyl, 165°.)

The strength of a pure spirit is ascertained by allowing 50 grams to remain with 10 c.c. $N/10$ silver nitrate solution and 5 c.c. ammonia solution for 24 hours in a well stoppered flask of 100 c.c. capacity, diluting to the mark, filtering from the precipitated silver sulphide, adding to 50 c.c. of the filtrate 4 c.c. of nitric acid and a few drops of ferric sulphate solution, and titrating with $N/10$ ammonium thiocyanate solution; of this, not more than 2·5 c.c. should be used (this corresponds with a minimum of 0·0575 per cent. of secondary butylthiocarbimide in the spirit).

A qualitative and quantitative examination may be combined in one operation by means of the polarimeter, secondary butylthiocarbamide having a specific rotation $[\alpha]_D = +33{\cdot}43°$. Of the spirit, 100 grams are heated with 10 c.c. of ammonia for 3 hours on the water-bath, in a flask furnished with an air condenser, the liquid is evaporated, the residue dissolved in 10 c.c. of warm water, and the solution, filtered if necessary, examined in a 2 dcm. tube in the polarimeter; it should have a rotation of about 0·5° (which corresponds to 0·06515 per cent. of secondary butylthiocarbimide in the original spirit). C. F. B.

Silicotungstic Acid as a Reagent for Alkaloids. By Gabriel Bertrand (*Compt. rend.*, 1899, **128**, 742—745).—Silicotungstic acid has great advantages as a general reagent for alkaloids; it is extremely sensitive, its molecular weight is very high, and the compounds which it forms with the alkaloids are definite and very stable. A 5 per cent. solution is convenient. The precipitates are white, yellow, or salmon colour, are flocculent, pulverulent, or even crystalline, and are readily collected and filtered. They are but little affected even by somewhat concentrated acids, and when strongly heated leave a residue of silicic and tungstic anhydrides only. They have the composition $12WO_3,SiO_2,2H_2O,4A+nH_2O$, where A is the alkaloid. The quantity of water of crystallisation varies with the alkaloid, and part at least is expelled at 120°. The pyridine compound crystallises with $1H_2O$, the morphine compound with $9H_2O$, and the strychnine compound with $8H_2O$. If the precipitates are heated in the liquid in which they are formed, they lose water, and in some cases, such as aconitine and veratrine, the character of the precipitate becomes so altered that it is more readily visible and the sensitiveness of the reaction is greatly increased. The limits of the reaction, using 5 c.c. of the alkaloid solution and adding 1 to 2 drops of the reagent and 1 to 2 drops of dilute hydrochloric acid (1 : 10), are as follows: Conicine, 1 : 8,000; morphine, 1 : 16,000; theobromine, 1 : 18,000; nicotine, 1 : 20,000; narceine, 1 : 30,000; codeine, 1 : 40,000; atropine and caffeine, 1 : 50,000; cocaine, 1 : 200,000; aconitine, 1 : 80,000; veratrine, 1 : 130,000; brucine, 1 : 150,000; strychnine and narcotine, 1 : 200,000; quinine, quinidine, cinchonine and cinchonidine, 1 : 500,000. In the case of aconitine and the following alkaloids, the sensitiveness of the reaction is increased after adding the reagent by boiling the liquid and then cooling, and the limits specified apply to this manner of working.

Since the silicotungstates are attacked by oxidising agents, the characteristic colour reaction of the alkaloid can often be applied directly to the silicotungstic precipitate. The alkaloids are, however, very easily liberated from the precipitate by treatment with dilute alkali hydroxide solutions; the silicic and tungstic acids dissolve, and the alkaloid either remains insoluble or dissolves, as the case may be.

C. H. B.

Estimation of Alkaloids in Pomegranate Bark. By Erich Ewers (*Arch. Pharm.*, 1899, **237**, 49—57).—The following modification of Keller's process for estimating nicotine (*Ber. pharm. Ges.*, 1898, 145) has been found suitable:—Six grams of the powdered bark are placed in a vessel of 200 c.c. capacity, 60 c.c. of ether, 60 c.c. of light petroleum, and 10 c.c. of 20 per cent. aqueous caustic potash or soda are added, and the mixture is shaken long and vigorously at intervals during half an hour, after which it is allowed to remain for four hours. One hundred c.c. of the ethereal solution are poured off through a small filter into a vessel of 200 c.c. capacity, 10 drops of an alcoholic solution of methyl orange are added, and *N*/20 acid is added, a little at a time, until a slight excess is present; after each addition the mixture is vigorously shaken, a pink colour in the aqueous solution after it has settled indicating excess of acid. This excess is then titrated with *N*/50 caustic potash, the mixture being shaken after each addition as before. The number of c.c. of *N*/20 acid used multiplied by 0·007375 gives the weight of alkaloids contained in 5 grams of the bark. Specimens of the bark of roots coming from S. France contained 0·63—0·72 per cent. of alkaloids, of the bark of branches, 0·52 per cent. The percentage diminishes when the drug is stored; samples purchased in druggists' shops contained from 0·40—0·41 when stored whole or in chips, 0·33—0·38 when stored in the form of powder.

It is said that, of the alkaloids contained in the bark, only the pelletierine and isopelletierine are of value as a vermifuge, the pseudopelletierine and methylpelletierine having but little effect. In order to estimate the former, the mixture left at the close of the titration described above is made just acid with *N*/20 acid, 2 grams of sodium hydrogen carbonate are added, and the whole is shaken vigorously. (The alkali decomposes the salts of pseudo- and methylpelletierine only.) After the mixture has remained for half an hour, 90 c.c. of the ethereal solution are filtered off, and titrated as above with *N*/20 acid, the excess of the latter being determined with *N*/50 alkali. The number of c.c. of acid used is divided by 0·9, and the quotient is subtracted from the number of c.c. used in the titration of the total alkaloids; the remainder multiplied by 0·00705 gives the weight of pelletierine and isopelletierine in the bark. These were found in various samples to form 40—50 per cent. of the total alkaloids present; as the variation is so slight, a determination of the total alkaloids suffices to indicate the value of a sample of the drug. C. F. B.

Estimation of Urinary Indican. By EYVIN WANG (*Zeit. physiol. Chem.*, 1899, **27**, 135—140).—Fresh work has shown the necessity of modifying the process previously described (Abstr., 1898, ii, 659), so that it now runs as follows: The urinary indican is precipitated with a 20 per cent. solution of lead acetate. The clear filtrate is treated with an equal volume of Obermayer's reagent, and the indigo extracted with chloroform. The chloroform is distilled off, and the residue, after cooling, washed out with a mixture of equal volumes of ether, alcohol, and water; the particles of indigo are collected on a filter and dried. The dried deposit is thoroughly boiled with chloroform; the chloroform is then distilled off, concentrated sulphuric acid added, and after some hours the solution is diluted with water, filtered, and titrated. W. D. H.

Estimation of Indoxylsulphuric (Indican) Acid in Urine. By FRITZ OBERMAYER (*Chem. Centr.*, 1899, i, 68—69; from *Wien. klin. Rundschau*, 1898, 537).—10 or 20 c.c. of the urine are diluted to 50 c.c. and mixed in a separating funnel with 50 c.c. of fuming hydrochloric acid containing 1—2 grams of ferric chloride per litre. After 15 minutes, the indigo which has been formed from the indican is isolated by first agitating with 25 c.c. and then with repeatedly renewed quantities of 10 c.c. of chloroform. The chloroform extract is evaporated and the residue heated for a few minutes on the water-bath with 50 c.c. of 45 per cent. alcohol to remove other colouring matters, the alcohol being carefully poured off. The indigo, which adheres firmly to the dish, is then dissolved in 5 c.c. of strong sulphuric acid, gently heated for 15 minutes on the water-bath, the solution, after cooling, diluted to a definite volume, and an aliquot part titrated at 50—80° with a solution of potassium permanganate containing 0·0256 gram per litre, 1 c.c. of which equals 0·0005 gram of indigotin. It is advisable to make a preliminary rough estimation in order to judge how much urine should be used. Some impurities may be removed by the careful addition of a solution of lead acetate (1 : 5) avoiding any excess (Abstr., 1891, ii, 248).

L. DE K.

Estimation of Bile-pigment in Urine. By ADOLF JOLLES (*Zeit. physiol. Chem.*, 1899, **27**, 83—94).—The method previously described (Abstr., 1894, ii, 466) is well suited for the estimation of bile-pigment in urine. W. D. H.

Detection of Urobilin in Urine. By SAILLET (*Zeit. anal. Chem.*, 1899, **38**, 131; from *Rev. méd.*, 1897, No. 2).—Freshly passed urine contains, not urobilin, but its chromogen, which, however, by exposure to sunlight for a few minutes, or to diffused daylight for several hours, is converted into urobilin. From urine acidified with acetic acid, ethylic acetate extracts the urobilinogen, and does not give it up to water, but after exposure to light, or the addition of nitric acid, urobilin can be removed by water and approximately estimated by spectrophotometry. M. J. S.

Ammonium Persulphate as a Reagent for the Detection of Albumin in Urine. By CASIMIR STRZYZOWSKI (*Chem. Centr.*, 1899, i, 151—152; from *Schweiz. Wochschr. Pharm.*, **36**, 545—546).—5 to 10 c.c. of the filtered urine is placed in a test-tube and, by means of a pipette, a 10 per cent. solution of ammonium persulphate is introduced below the liquid. If albumin is present, a greyish-white ring forms at the surface of contact of the liquids. The test still shows at a dilution of 1—100,000; it is not interfered with by peptones or urates, but in the presence of biliary matters the ring is coloured green.

L. DE K.

Detection and Estimation of Proteids, Diastases, Alkaloids, Leucomaines, and Toxins, especially in Urine. By PAUL CHIBRET (*Compt. rend.*, 1899, **128**, 431—433).—A solution of iodine, 47 grams, and potassium iodide, 58 grams, in water, 60 grams, is employed as a reagent for the detection of nitrogenous bases, peptones, proteids, leucomaines, toxins, &c., in water or urine, and their approximate estimation by observing the degree of dilution at which a standard turbidity is produced. The reagent has no action on urea or uric acid.

In a very carefully cleaned tube, 2 c.c. of a solution of 1 part of cocaine hydrochloride in 800,000 parts of water is mixed with 3 drops of nitric acid and 3 drops of the iodine reagent, and the liquid seems to remain clear, but if very carefully observed under suitable conditions of lighting is found to be slightly opalescent; this is the standard of turbidity. It does not represent the limit of the reaction, which is 1 : 2,000,000, but is a convenient standard to work with. The degree of dilution necessary to give the same turbidity is, with egg albumin and peptones, 1 : 20,000; creatinine, 1 : 1000; xanthine, 1 : 5000; pepsin, 1 : 50,000, and alkaloids, 1 : 800,000. In the case of proteids in urine, if they are of alimentary origin the necessary dilution is from 1 : 20,000 to 1 : 50,000, but if they are pathological products they may require dilutions of 1 : 140,000 or even 1 : 400,000.

Normal urine gives the turbidity with a dilution of 1 : 30 to 1 : 40, but with malnutrition this may rise to 1 : 10. In the case of febrile and infectious diseases, the dilution may be 1 : 100 or even 1 : 200. The difference between the necessary coefficient of dilution before and after precipitation of the albumin gives the coefficient due to the albumin. C. H. B.

Artificial Digestion of Food Constituents. By KONRAD WEDEMEYER (*Landw. Versuchs-Stat.*, 1899, **51**, 375—385).—To avoid uncertain results, gastric juice must be prepared from a large number of stomachs, and the amount of liquid obtained being more than is required for immediate use, it was proposed (Stutzer, Abstr., 1890, 275) to add salicylic acid in order to prevent its decomposition. Stutzer subsequently found thymol to be more suitable (*Landw. Versuchs.-Stat.*, 1892, **40**, 163).

Experiments are now described in which thymol (0·1), chloroform (0·5), formaldehyde (0·2), and toluene (0·5 and 1·0 per cent.) were employed for preventing the decomposition of the juice. This retains its activity for a considerable time when none of these substances are added, but soon acquires an intolerable odour. Chloroform was found to be the most suitable substance in digestion experiments with cotton-seed meal; with thymol, less of the nitrogen was digested. With other foods, the various substances behaved somewhat differently; formaldehyde, for instance, diminished the digestibility of brewers' grains, but not that of wheat bran. Further experiments showed that a solution of pepsin is more suitable, as well as much more convenient, than gastric juice. The process is as follows: The food (2 grams) is mixed in a beaker with 490 c.c. of water containing 1 gram of pepsin and 10 c.c. of 25 per cent. hydrochloric acid, and digested for 48 hours at 37—40°, being frequently stirred. After 24 hours, another 10 c.c. of the same acid is added. Finally, the whole is filtered, the undissolved substance washed successively with hot water, alcohol, and ether, and the nitrogen determined (in both substance and filter). The results differed at most from those obtained with gastric juice by + 0·079 and − 0·096 per cent., being in 17 cases somewhat higher, and in 11 cases somewhat lower. N. H. J. M.

General and Physical Chemistry.

A Source of Intense Monochromatic Light. By Ch. Fabry and A. Perot (*Compt. rend.*, 1899, **128**, 1156—1158).—An electric arc is employed passing between mercury poles in a vacuum. The apparatus consists of a cylindrical glass bulb filled to one-third its height with mercury, which is divided into two masses insulated from one another by means of a glass tube concentric with the walls of the bulb and opening nearly on a level with the mercury. Each mass of mercury is connected with a pole of a source of a continuous current by means of platinum wires fused through the glass. The bulb is made as completely vacuous as possible, and in order to strike the arc the apparatus is slightly shaken, which brings the two masses of mercury momentarily in contact. The difference of potential between the poles does not exceed 15 volts, but in order to secure a steady arc, 30 volts should be available. A current of two to three ampères is sufficient, but stronger currents may be used, and the intensity of the light may reach 1 Carcel (approx. 7·4 candles).

The spectrum of the light is identical with that of the light from Michelson's mercury vapour tubes, and consists of a violet ray 4358·0, a green ray 5460·7424, and two yellow rays 5769·5984 and 5790·6593; the separate rays can be isolated by means of a prism or by the use of suitable absorbents, such as yellow glass or potassium dichromate for the violet ray, a saturated solution of didymium chloride for the two yellow rays, and a solution of eosin for the violet and green rays. For photographic purposes, the ultraviolet rays should be cut off by an acid solution of quinine sulphate. C. H. B.

Double-trough Refractometer, and Experiments therewith on Solutions of Cadmium Bromide, Sugar, and Di- and Trichloracetic Acids and their Potassium Salts. By Wilhelm Hallwachs (*Ann. Phys. Chem.*, 1899, [ii], **68**, 1—45).—A form of refractometer is described which consists essentially of a trough of which two opposite sides are formed by two slightly inclined plates of glass with parallel surfaces. This is divided into two by a partition of glass with sides not perfectly parallel. On one side of the partition the trough contains water, and on the other the liquid under examination (*Ann. Phys. Chem.*, 1893, [ii], **50**, 577). The incident ray grazes the surface of the partition, passes into it at the critical angle, enters the second liquid, and finally emerges from the trough. The angle between the emergent rays when the incident ray is (1) direct, (2) reversed, is observed, and from this the difference between the refractive indices of the two liquids. The necessary calculations are given and the required expressions deduced, and experiments are recorded to show the accuracy attainable as well as the effect of temperature changes in either or both the trough divisions; differences of 0·0003 in the indices of refraction appear to be measurable with an accuracy of about 0·0000015. Le Blanc and Rohland

(Abstr., 1896, ii, 345) have found that the difference between the molecular refraction of cadmium bromide and iodide, which are but slightly dissociated, varies considerably from that between other more highly dissociated bromides and iodides in solution, but the author's results are not in accord with these, whilst he also shows that the density observations of Le Blanc and Rohland for cadmium bromide do not agree with those of Grotian and Kremers. The error was probably due to the neglect of the hydration of cadmium bromide, as corrections on this assumption bring all the observations into accord, and no indication is given of dependence of refraction on dissociation. For solutions of cane sugar, the change in the refraction is only about 0·4 per cent. between 0·4 and 13 per cent. solutions. A comparison of the differences between the refraction of the acid and its potassium salt in the cases of hydrochloric, dichloracetic, and trichloracetic acids shows that at great dilution the differences are very nearly equal —4·6 to 4·9—whereas at higher concentrations the differences are considerably greater, so that in hydrogen salts a connection between refraction and dissociation is indicated, as stated by Le Blanc (*loc. cit.*).

L. M. J.

Internal Resistance of Normal Cells. By Ernst Cohen (*Zeit. physikal. Chem.*, 1899, **28**, 723—736).—Measurements of the internal resistance of Clark's and Weston's cells have yielded very diverse values, and the author has investigated the cause of these differences. It was found that the formation of crystals between the electrodes greatly increases the resistance of saturated solutions of zinc sulphate, whilst the resistance is also dependent on the arrangement of the crystals, and this is the cause of the various values found with the normal cells. When filled with a clear saturated solution, the resistance of a Clark's cell at different temperatures was found to be proportional to that of the zinc sulphate solution, and analogous results were obtained with Weston cells. Thus prepared with clear solutions and a small quantity of depolarisor, normal cells can be conveniently employed for the graduation of galvanometer readings. L. M. J.

Relation between the Dissociative Power, the Dielectric Constant, and the Molecular Condition of Liquids. By Hans Euler (*Zeit. physikal. Chem.*, 1899, **28**, 619—628).—According to Dutoit, Aston, and Friderich, the dissociative power of a solvent is a direct function of its molecular association (Abstr., 1897, ii, 546); Nernst has also shown that a probable connection exists between the dissociative power and the dielectric constant (Abstr., 1894, ii, 266). As, however, the associated solvents employed by Aston and Dutoit in all cases had a high dielectric constant, further investigation was necessary. Solutions of potassium iodide and chloride, and of sodium bromide and iodide in nitrobenzene, benzonitrile, and furfuran, were found to have considerable conductivity, and are hence dissociated, although the solvents are in each case non-associated or monomolecular. In the case of the solutions in benzonitrile, the molecular conductivity was found to increase with the concentration, and this is considered to be due to an increased dissociative power owing to the presence of ions; this explanation probably accounts also for some of the exceptions from the dilution law. The molecular conductivity of the same salts in butyric, isobutyric, and valeric acids was found to be exceedingly small, although the association of the solvents is great. The dielectric constants are, however, also small, and Nernst's hypothesis is hence supported. L. M. J.

Electric Conductivity of Salt Solutions. By R. Goldschmidt and Albert Reychler (*Bull. Soc. Chim.*, 1898, **19**, [iii], 675—684).—An apparatus is described for determining electric conductivity, which is much smaller than the forms employed by Kohlrausch and Arrhenius. The electrolytic cell consists of a small ebonite cup, at the bottom of which is placed a platinum electrode coated with platinum black; the second electrode is fixed to the lower end of a vertical ebonite rod, and both the rod and the cup can be moved to and from each other in a vertical direction by means of micrometer screws. The exact distance between the electrodes is ascertained by means of a vernier and graduated circle attached to the movable parts of the apparatus. In one series of experiments, the diameters of the cup and electrodes were 47 mm. and 40 mm. respectively; a $N/50$ solution of potassium chloride was employed as the electrolyte, and the temperature of the apparatus was maintained at 18°. The electric capacity of the apparatus was calculated from the equation, $0{\cdot}002244 = 1/R \times$ capacity, the fraction 0·002244 being Kohlrausch's value for the specific conductivity of the solution, the value of the resistance, R, being determined with the electrodes at varying distances apart. These values were employed in determining the specific conductivity of a $N/500$ solution of the same electrolyte. The results are arranged in tabular form and compared with those obtained from an apparatus of the Arrhenius form.

A second series of experiments was made with a smaller apparatus, the diameters of the cup and electrodes in this case being 17·3 mm. and 14·3 mm. respectively, and the cup having a capacity of 3 c.c. It is found that the conductivity increases as the distance between the electrodes diminishes. The irregularity observed when the electrodes are very close together is due, not only to polarisation, but also to the abnormal behaviour of the layers of the solution in close proximity to the electrodes. The ratio between the increase of resistance and the increase of the distance between the electrodes is constant only for that portion of the electrolytic solution where the equipotential surfaces are plane and parallel to each other; this condition does not obtain in the immediate neighbourhood of the electrodes. In order to eliminate this source of error, the conductivity of the solution is calculated in the following manner: Rm and Rn being the resistances obtained with the standard solution when the electrodes are m and n millimetres apart, and $R'm$ and $R'n$ the corresponding values for the solution under investigation, the specific conductivity of the latter is $0{\cdot}002244 \times (Rm - Rn)/R'm - R'n$. A table is given which shows that, by the aid of this expression, it is possible to obtain accurate results with the smaller apparatus; in working with this form, it is convenient to fix the key of the Kohlrausch bridge at a convenient resistance, and then to make the final adjustment by means of the micrometer screw of the upper electrode. The electric capacity of the instrument having been previously determined for any position of the electrodes, the specific conductivity is readily obtained from the equation sp. c. $= 1/R' \times$ capacity. G. T. M.

Electrical Oscillations. By HUGO KAUFFMANN (*Zeit. physikal. Chem.*, 1899, **28**, 673—707).—Drude has shown that hydroxy-compounds are characterised by anomalous absorption of electrical oscillations (Abstr., 1897, ii, 537). The author, however, shows that this is not limited to such compounds, and considers it to be associated with compounds containing some feeble union. In the series of saturated fatty alcohols, the extent of this absorption does not follow the same order as the velocities of hydrolysis, which may be taken as a measure of the looseness of the hydrogen union in the hydroxyl, and the author therefore considers that the absorption is most marked for a certain "critical stability" and decreases as the stability is removed in either sense from this. Besides hydroxyl, the following groups appear to cause anomalous absorption: nitro-group, NO_2; azoxy-group, N_2O; the characteristic group, ⋮CH, in the leuco-bases, and the carboxyl group in the ethereal salts of substituted carboxylic acids. The absorption of Tesla oscillations by organic compounds in the state of vapour was also further examined (Abstr., 1898, ii, 550), about 75 more compounds being investigated. The following generalisations are now deducible. Aromatic compounds exhibit a much more marked luminescence than aliphatic compounds. Halogens or the nitro-group destroy or weaken the luminescence (this is very marked in naphthalene compounds). Introduction of an acetyl group in a hydroxy-compound or an amine destroys or lowers the luminescence, but the introduction of an alkyl group has no effect. The amido-group converts an inactive into an active compound, whilst two hydroxyl groups produce the same effect, one being, however, insufficient; the author applies the term 'auxochrome' to the groups NH_2 and OH or their derivatives. In di-derivatives of the benzene series, the para-compound is, as a rule, the most active, the cause of the activity probably lies in the nature of the benzene nucleus, and in active compounds there appears to be a predisposition to the formation of compounds of quinonoid structure, although the quinones themselves are inactive. L. M. J.

Regularities in the Boiling Point of Liquids in Exhausted. Vessels. By FRIEDRICH KRAFFT (*Ber.*, 1899, **32**, 1623—1635 Compare Abstr., 1896, ii, 89, 464 and 635).—I. In the distillation of high molecular liquids in the vacuum of the cathode light, the difference in temperature between the liquid and vapour is very slight; thus, palmitic acid, boiling in the vacuum of the cathode rays, showed a temperature of 137·5—138° in the liquid, and 136—137° in the vapour. The boiling point is, however, influenced very largely by the height of the vapour column above the liquid; thus, elaidic acid begins to boil at 142°, but the boiling point rises to 154° as the vapour column mounts up to the side-limb of the distilling flask, 65 mm. above the surface of the liquid. The vapour column is very sharply defined; it can be measured to 1 mm., and a bright cathode light can be obtained only 20 or 30 mm. above the limit of the saturated vapour.

II. By exact measurement, it was found that phenyl pentadecyl ketone boiled at 161° under a vapour column of 90 mm., at 164·5° for 110 mm., at 170·5° for 145 mm., and at 176° for 180 mm., giving an average rise of 1·66° in the boiling point for an increase of 10 mm. in the height of the vapour column. An increase in the height of the vapour column from 65 to 180 mm. gave, for lauric acid, mol. wt. 200, a rise in boiling point of 9·5°; for palmitic acid, mol. wt. 256, a rise of 15·7°, and for elaidic acid, mol. wt. 282, a rise of 19°; these increments are not proportional to the molecular weights, but the value for palmitic acid is 6·2° = 2 × 3·1° greater than that for lauric acid for a difference of 56 in mol. wt., whilst the value for elaidic acid is 9·5° = 3 × 3·16° greater for a difference of 82 in mol. wt. The rise of temperature on increasing the height of the vapour column from 65 to 175 mm. was 18° for hexadecane, mol. wt. 226, and 36° for dotriacontane, mol. wt. 450, so that an exact proportionality appears to exist in the paraffin series.

III. The interval between the melting point and the boiling point of the higher paraffins under 15 mm. pressure increases by 6° for each additional CH_2 group. If, however, the boiling points are determined in a vacuum at 0 mm. pressure, with a vapour column of 65 mm., the regularity is still more marked, for the interval between melting point and boiling point can be calculated directly from the formula $n \times 4·22°$, where n is the number of carbon atoms in the molecule; the agreement between the observed and calculated values is very close from $C_{20}H_{42}$ to $C_{32}H_{66}$, but for the lower homologues the calculated values are always greater than the observed, the deviation being explained by the gradual change in the percentage composition of the paraffin. For the fatty acids, the corresponding increment is about 4·6° for each additional CH_2 group. T. M. L.

[Thermochemistry of] Morphine and its Salts. By Émile Leroy (*Compt. rend.*, 1899, **128**, 1107—1110).—The heat of combustion of hydrated morphine is 2146·7 Cal. at constant pressure and 2145·2 Cal. at constant volume. The heat of solution of the anhydrous base is 8·51 Cal., and that of the hydrate is 4·85 Cal.; hence the heats of hydration of morphine with water and ice are 3·66 and 2·10 Cal. respectively. The heat of formation of anhydrous morphine from its elements is 108·24 Cal. The following table gives the heat of neutralisation with various acids.

	Morphine hydrate.	Anhydrous base.
Hydrochloric acid...............	3·52 Cal.	7·18 Cal.
Sulphuric ,, ($\frac{1}{2}H_2SO_4$)...	4·85 ,,	8·51 ,,
Nitric ,, ...	3·39 ,,	7·05 ,,
Acetic ,, ...	2·70 ,,	6·36 ,,
Oxalic ,, ($\frac{1}{2}H_2C_2O_4$)..	3·66 ,,	7·32 ,,

The addition of excess of acid produces a slight thermic effect, which is positive in the case of the monobasic acids and negative with the dibasic acids; the addition of excess of base is not accompanied by any thermal change.

The heats of solution of the crystalline salts, $\overline{M},HCl,3H_2O$, $M_2,H_2SO_4,5H_2O$, and $M_2,H_2C_2O_4,4H_2O$, are $-9{\cdot}47$, $-9{\cdot}74$, and $-9{\cdot}87$ Cal. respectively; the heat of hydration of the hydrochloride with $3H_2O$ (liquid) is 6·08 Cal., and with $3H_2O$ (solid) 1·39 Cal. The heat of formation of the dry hydrochloride from anhydrous morphine and hydrogen chloride is 27·97 Cal.; the corresponding constants for isoquinoline and paratoluidine are 25·67 and 23·65 Cal. respectively; morphine is the stronger base; it is alkaline to litmus, whereas the other two are not. The heat of solution of morphine hydrate in dilute caustic potash at 12° is 4·79 Cal.; the heat of formation of the potassium derivative from anhydrous morphine is 8·45 Cal., whereas that of potassium phenoxide from solid phenol and dilute potash solution is only 5·6 Cal. The addition of a second molecule of morphine or alkali hydroxide produces a development of heat; this result indicates that the potassium derivative is slightly dissociated in aqueous solution. The heat developed by the decomposition of morphine hydrochloride (1 mol.) dissolved in 10 litres of water by caustic potash (1 mol.) is 10·52 Cal.; when the precipitated morphine is redissolved by the addition of more potash (1 mol.), the heat generated is 4·75 Cal.; this value is almost identical with the heat of solution of crystallised morphine hydrate in caustic potash. The heat effect due to the precipitation of the alkaloid is not produced instantaneously, but during an interval of 2 or 3 minutes; these results indicate that morphine liberated from its salts by an alkali is slowly converted into the hydrated form. G. T. M.

Increase of Pressure caused by the Mixture of two Gases, and the Compressibility of the Mixture. By DANIEL BERTHELOT (*Compt. rend.*, 1899, **128**, 1159—1160).—The values calculated for the increase in pressure due to the mixing of gases, assuming a series of operations such that diffusion takes place in a state of perfect gas and using the values for compressibility determined by the author and Sacerdote (this vol., ii, 404), agree closely with the experimental results, and hence the use of the cycle proposed (*loc. cit.*) is justifiable. C. H. B.

Calculation of the Compressibility of a Gaseous Mixture from that of its Components. By DANIEL BERTHELOT (*Compt. rend.*, 1899, **128**, 1229—1231).—A mathematical discussion not suitable for abstraction. G. T. M.

Baumé's Hydrometer—American Standard. By SIDNEY S. EMERY (*J. Amer. Chem. Soc.*, 1899, **21**, 119—132).—Tables are given of the specific gravities corresponding with every 1/10 or every 1/8 degree of Baumé's scale, from sp. gr. 0·6667 to 1·9833. T. M. L.

Specific Gravity of some Liquefied Gases. By ALBERT LADENBURG and C. KRÜGEL (*Ber.*, 1899, **32**, 1415—1418).—Having been made acquainted with Dewar's researches on the subject (*Proc. Roy. Inst.*, 1896, **15**, 138; compare Proc., 1895, **11**, 226), the authors have redetermined the specific gravity of certain liquefied gases by weighing in the liquid a sinker, not of glass (compare this vol., ii, 208) but of silver (Dewar, *loc. cit.*); the results are now found to be more in harmony with his. Liquid oxygen has the density 1·134 (Dewar 1·1375); liquid ethylene, 0·6095; whilst a liquefied mixture of oxygen and nitrogen containing x per cent. of oxygen has the density $d=0{\cdot}86+0{\cdot}00289x$ (experimental numbers: $d=1{\cdot}015$, 1·068, 1·133 when $x=53{\cdot}6$, 72·15, 94·4 respectively).

By weighing sinkers of silver, ordinary glass, Jena glass and silver in succession in liquid air, and assuming the coefficient of expansion for silver given above, the mean coefficient of expansion between the ordinary temperature and that of liquid air (density 1·1215) boiling under atmospheric pressure was found to be 0·00003104 for ordinary glass, 0·00001822 for Jena glass. C. F. B.

New Apparatus for the Determination of Volume. By Charles F. McKenna (*J. Amer. Chem. Soc.*, 1899, **21**, 50—52).—An improved form of volumenometer of the Schumann or Candlot type. It consists of a flask of about 175 c.c. capacity with two vertical necks, one of which, having a diameter of about 5 mm., is graduated in tenths of a c.c., and closed at the top by a perforated stopper. The other tube, which is shorter, has a zero mark at about its middle point, on either side of which it is graduated for one or two c.c.; above the graduation, it expands to about 25 mm. diameter, and into it fits a perforated glass stopper, connected by means of a tube fitted with a stopcock with a rubber bulb. The mode of using is as follows. Liquid is introduced into the flask, the level in the shorter tube adjusted to zero by means of the rubber bulb, and the volume obtained by reading off the position of the liquid in the other limb. After removing the stopper from the shorter tube, the powdered solid is sifted in, the liquid adjusted to zero, and the volume again read off on the longer tube. The apparatus can be conveniently used with about 10 grams of material. T. H. P.

Composition of Mixed Vapours. By Hector R. Carveth (*J. Physical Chem.*, 1899, **3**, 193—213).—In only a few exceptional cases does the vapour given off by a binary system possess the same composition as the liquid, and although of great importance in fractional distillation, the connection between the composition of the two phases has been little studied. A form of apparatus for the determination of the composition of the vapour is described, the principle of the method being that the condensed vapour is returned to a small receiver within the larger flask containing the solution whose boiling point is being taken, and in this receiver is made to boil. From this boiling point, the composition of the condensed vapour is determined by comparison with the boiling point curve of the two liquids. The cases examined were mixtures of (1) acetone and water, (2) benzene and carbon bisulphide, and the temperature | composition curves for liquid and vapour are given. The results obtained are verified by comparison with those derived from the direct analysis of the liquid volatilised between two temperatures sufficiently near to allow of a mean being taken. Brown's method of a constant temperature still-head

(Trans., 1881, **39**, 304) is inaccurate, as discrepancies are found in his results, the composition of the vapour being always displaced to the side of the more volatile compound. Purity of a compound is in general indicated by the identity of the boiling points of the liquid and condensed vapour. During the experiments, it was noticed that, in many cases where the composition of liquid and condensed vapour differ considerably, the Beckmann apparatus does not yield accurate results, differences of one degree being obtained by alteration of the rate of boiling. L. M. J.

Molecular Weights of Liquids. III. By CLARENCE L. SPEYERS (*J. Amer. Chem. Soc.*, 1899, **21**, 282—287. Compare this vol., ii, 145).—From Lehfeldt's vapour-pressure measurements (this vol., ii, 11), it is concluded that, in mixtures of benzene and toluene with carbon tetrachloride, both constituents have a normal molecular weight. When mixed with alcohol, however, both benzene and toluene are said to be highly polymerised, especially when the proportion of alcohol is small; the alcohol is regarded as highly polymerised in presence of a small proportion of toluene, but less so when the proportion is large; in benzene solution, the alcohol is regarded as being highly polymerised at all concentrations. T. M. L.

Continuous Change from Solid to Liquid. By GEORGE A. HULETT (*Zeit. physikal. Chem.*, 1899, **28**, 629—672).—It having been suggested that crystalline-liquids are in a state approximating to the critical state (this vol., ii, 360), experiments were made to determine whether the heat of transition of the compounds becomes zero at higher pressures. The value of the heat of transition (that is, the change from crystalline-liquid to isotropic) is calculated from the lowering of the transition temperature by means of the expression $L = 0{\cdot}02n.T^2/d$, where d is the depression produced by n gram-molecules dissolved in 100 grams of the solvent, and T the absolute transition temperature. The temperatures were determined at pressures up to 300 atmospheres in the case of parazoxyanisoil and parazoxyphenetoil, and of solutions of thymol in these solvents. The latent heats of transition for parazoxyanisoil thus found were $L_0 = 4{\cdot}33$ and $L_{300} = 4{\cdot}36$ cal.; and for parazoxyphenetoil $L_0 = 7{\cdot}2$ and $L_{300} = 6{\cdot}6$ cal., so that the experimental pressures appear to be far removed from the critical pressure. The latent heat is also calculable from the volume change and the pressure coefficient of the temperature, but the values so calculated do not agree with the previous results, being far smaller. The cause of this difference is probably the solubility of the thymol in the crystalline-liquid, as not only the transition temperature, but also the melting point, is lowered by the addition of the thymol. The existence of a critical point for the solid crystalline-liquid was also investigated by the determination of the lowering of the melting point at various pressures, and application of the van't Hoff formula. The values so obtained were: parazoxyanisoil, $l_0 = 29$ cal., $l_{300} = 36{\cdot}5$ cal.; parazoxyphentoil, $l_0 = 14{\cdot}7$, $l_{300} = 22{\cdot}3$ cal., so that the critical pressure appears to be a negative pressure of about 1000 atmospheres. For both compounds, the temperature range of the crystalline-liquid increases with rise of pressure, so that a negative pressure is also indicated for the disappearance of this state. The pressure coefficients of the melting and transition points were also determined for pure cholesterylic benzoate, and from these, and the volume change, the heat of transition is calculated as 0·32 cal. The latent heat of fusion was also similarly determined for paratoluidine, benzene, and camphor, and in each case it was found to decrease with rise of pressure, the values obtained being: paratoluidine, $l_0 = 39$, $l_{300} = 37·1$; benzene, $l_0 = 30·2$, $l_{300} = 27·7$; camphor, $l_0 = 9·4$, $l_{300} = 8·0$ cal. From these, by subtraction of the external work, the internal heat of fusion is obtained, the difference being about 1 cal. in each case. The effect of pressure on the melting point was also investigated for many organic compounds, the temperature being found in all cases to be a linear function of the pressure, and the following values of the pressure coefficient in degrees per atmosphere were obtained: phenol, 0·0149; thymol, 0·0184; naphthalene, 0·0373; naphthylamine, 0·0200; benzophenone, 0·0289; stearic acid, 0·0258; crotonic acid, 0·0373; orthonitrophenol, 0·0240; phosphorus, 0·0290; menthol (m. p. 36·5°), 0·0248; menthol (m. p. 42·5°), 0·0245; monochloracetic acid, 0·0147. The results for benzene, benzophenone, and phosphorus are shown to be in good accord with observations of Tammann, but the pressures were not carried sufficiently high to indicate curvature of the temperature | pressure curve.

L. M. J.

NOTE.—The results do not appear to agree with those of Damien (*Compt. rend.*, 1891, 112—785), who found in all cases a quadratic formula for the pressure effect. The difference is very marked for naphthylamine, for which Damien found a maximum melting point of 50·5 at 81 atmospheres, the value then decreasing to 49·6 at 173 atms., whereas the author obtains a steady rise from 49° to 54·8° at 300 atms., the value at 175 atms. being 52·3. L. M. J.

Surface-tensions of Solutions of Alkali Chlorides. By CHARLES E. LINEBARGER (*J. Amer. Chem. Soc.*, 1899, **21**, 411—415).—The author has determined the relation between the surface-tensions and concentrations of solutions of lithium, sodium, and potassium chlorides. On constructing curves with surface-tensions as ordinates, and concentrations as abscissæ, it is seen that the curve for sodium chloride lies about midway between those for the potassium and lithium salts, the surface-tension being greater the smaller the molecular weight. If the concentrations be expressed in molecules per litre, the three curves become coincident. The surface-tension is not, as is generally supposed, a linear function of the concentration, as the curves show a slight convexity towards the axis of concentrations.

T. H. P.

Ternary Mixtures. By WILDER D. BANCROFT (*J. Physical Chem.*, 1899, **3**, 217—231).—It has been shown by Taylor (Abstr., 1897, i, 402), that in a ternary mixture of two non-miscible liquids with a third consolute liquid, the concentrations are connected by the relation $(C_a|A_a)^n = k.C_b|B_b$ where C_a and C_b are the concentrations of the consolute liquid, and A_a and B_b those of the other two liquids in the two phases. Many cases of metallic ternary mixtures have been described by Wright (Abstr., 1891, 1158; 1893, ii, 15, 415, 522; 1894, ii, 419), and the author has examined the results in order to test their agreement with the above expression. The experimental errors were acknowledged by Wright to be great, but notwithstanding this, in some of the systems very fair constancy for k is obtained. In most cases, except where silver is the consolute metal, the distribution ratio is less than 2, and there appears to be no connection between the distribution ratio at great dilution and the reacting weights of the two metals. Thus in lead-zinc mixtures the ratio varies from 1·5 for tin as consolute to 39 for silver. The inexactitude of the experiments, however, makes further investigation desirable. L. M. J.

Inversion of Sugar by Salts. By LOUIS KAHLENBERG, D. J. DAVIS, and R. E. FOWLER (*J. Amer. Chem. Soc.*, 1899, **21**, 1—23).—By determining the rate of inversion of sugar by the action of a number of colourless salts, firstly, from the polariscopic readings, and secondly, by calculating the number of molecules in the solution by means of the freezing point method, the authors show that the latter method gives reliable results. By this means, the rates of inversion have been measured for coloured salts with which accurate polariscopic determinations cannot be made. The results show that on arranging the metals according to the speed with which their analogous salts invert sugar solutions, the order is similar to that in the electrochemical series. To this general rule an exception is found in aluminium, the salts of which have relatively a very high velocity of hydrolysis; this may be due to the formation of a colloidal aluminium hydroxide, which would tend to aid the ionic dissociation of the salts and hence promote inversion of the sugar. Confirmation is given of Long's statement (Abstr., 1896, ii, 414, and 1897, ii, 547), to the effect that metallic chlorides invert sugar much more rapidly than the corresponding sulphates, owing to the ionising tendency of chlorine being greater than that of the SO_4 complex. T. H. P.

Nature of Valence. By FRANCIS PRESTON VENABLE (*J. Amer. Chem. Soc.*, 1899, **21**, 192—200 and 220—231).—The variation in the valency of an element is explained as due to the necessity for harmony between the motions of the combining atoms, which may be affected by temperature, light or electricity, or by the mutual influence of the atoms. T. M. L.

The Boiling of Aqueous Colloidal Solutions. By FRIEDRICH KRAFFT (*Ber.*, 1899, **32**, 1584—1596).—The salts of the higher fatty acids behave as colloids in aqueous solution, but as crystalloids when dissolved in perfectly dry alcohol. In determining the boiling point of colloidal solutions, a difficulty occurs owing to the formation of bubbles, the tension of which materially increases the pressure on the boiling liquid; this can be largely overcome by using a deep layer of glass beads to break up the bubbles.

The addition of 7·88 grams of sodium palmitate to 30 grams of water raised the boiling point by only 0·083°, whilst if the molecule were dissociated in the ordinary way, a rise of more than ten times this amount might be expected; a further addition of sodium chloride gave, however, a normal rise of temperature corresponding with $M = 26\cdot2$, the value in pure water being 29·2. With sodium erucate there was a rise of 0·017° (partly due to 1 mm. increase of pressure) instead of 0·200°; a further addition of sodium chloride gave a rise corresponding to $M = 27$ instead of 29·2; in a second experiment, the rise of temperature was only 0·001° instead of 0·295°, and a subsequent addition of potassium bromide gave $M = 68$ instead of 59·5. Sodium oleate caused no rise in temperature, although a rise of 0·58° should have occurred if the salt were dissociated in the ordinary way; subsequent addition of sodium chloride gave $M = 30\cdot8$ instead of 29·2. Potassium oleate gave a rise of 0·005° instead of 0·328°; potassium erucate showed a fall of 0·015°, owing to a fall of 0·8 mm. pressure; potassium stearate gave a rise of 0·015° on adding 3·89 to 30 c.c. of water.

The values of M, when determined in anhydrous alcohol, were potassium formate, 87·60, theory 84·16; potassium acetate, 93·3, 94·9, 96·7, theory 98·18; sodium heptoate, 180, theory 152·2; potassium heptoate, 153·7, 156·5, 156·5, theory 168·3; sodium laurate, 237·2, theory 222·3; sodium myristate, 253, theory 250·3; sodium palmitate, 282·6, theory 278·4; sodium oleate, 301·3, theory 304·4. The presence of a small amount of water in the alcohol causes a very large increase in the values of M. T. M. L.

Crystallisation of Colloidal Salt Solutions. By FRIEDRICH KRAFFT (*Ber.*, 1899, 32, 1596—1608. Compare Abstr., 1896, ii, 468). —I. The temperature at which aqueous soap solutions gelatinise or deposit a solid soap is determined almost entirely by the melting point of the fatty acid contained in the soap. Thus dry sodium stearate melts at about 260°, but a 20 per cent. solution solidifies at 69°, a 15 per cent. solution at 68°, a 10 per cent. solution at 68—67°, and a 1 per cent. solution at 60°, the melting point of stearic acid being 69·4.° Dry sodium palmitate melts at 270°, but a 20 per cent. solution solidifies at 62—61·8, and a 1 per cent. solution at 45°, the melting point of palmitic acid being 62°. Dry sodium myristate melts at 250°, but a 20 per cent. solution solidifies at 53—52°, and a 1 per cent. solution at 31·5°, the melting point of myristic acid being 53·8°. Dry sodium laurate melts at 255—260°, but a 25 per cent. solution solidifies at 45—42°, a 20 per cent. solution at about 36°, and a 1 per cent. solution at about 11°, the melting point of lauric acid being 43·6°. The agreement between the melting point of the fatty acid and the temperature at which the sodium salt solidifies from the solution is most marked among the highest homologues, and it is here also that the concentration has least influence on the temperature of solidification.

Similar results are found in the unsaturated series. Dry sodium oleate melts at 232—235°, but a 25 per cent. solution solidifies at 13—6°, the melting point of oleic acid being 14°. Dry sodium elaidate melts at 225—227°, but a 20 per cent. solution solidifies at 45·5—44·8°, the melting point of elaidic acid being 45°. Dry sodium erucate melts at 230—235°, but a 20 per cent. solution solidifies at 35—34°, and a 1 per cent. solution at 27°, the melting point of erucic acid being 34°.

Dry sodium brassidate melts at 245—248°, but a 20 per cent. solution solidifies at 56°, the melting point of brassidic acid being 60°.

In explanation of these observations, it is suggested that when it is dissolved in water, the soap is completely hydrolysed into caustic soda and a fatty acid. The fatty acid is not soluble by itself, but is held in solution by the caustic soda, and the molecules of the fatty acid and base are regarded as grouped into large molecular complexes, giving rise to *colloidal* solutions, as has been shown in the preceding abstract. These colloidal solutions can only exist above the melting point of the fatty acid, but in the lower homologues the melting point is lowered by partial miscibility with water and the soap solution solidifies at a lower temperature, especially when dilute. Crystallisation occurs least readily when the alkali of the soap has a great affinity for water. Thus potassium soaps remain gelatinous at a much lower temperature than sodium soaps; on the other hand, lithium soaps are almost insoluble owing to the feeble affinity of the base for water.

An attempt is made to extend these observations to the hydrochlorides of feeble bases. It is shown that hexadecylamine hydrochloride, which decomposes at 150° when dry, crystallises from a 20 per cent. aqueous solution at 45—42°, the free base melting at 46°. A number of other cases are given, but there does not appear to be any marked relationship between the melting point of the base and the temperature at which the salt solutions crystallise, the discrepancy being perhaps due to the solubility of the amine.

II. 'The crystallisation of salts results from a disturbance of the system present in the solution; the effects of this disturbance are less marked the lower the temperature at which the crystallisation takes place.' Colloidal solutions deposit globular aggregates, and the author has therefore assumed (*loc. cit.*) that such solutions have a concentric configuration or form of motion. It is now shown that certain crystalloids can be made to separate in globular forms by careful over-cooling, and it is therefore assumed that these solutions also possess a concentric structure. T. M. L.

Colloidal Salts as Membrane-formers in Dyeing. By Friedrich Krafft (*Ber.*, 1899, **32**, 1608—1622).—"Dyeing in the great majority of cases consists in the separation of colloidal salts on or in the fibre." Colours of low molecular weight and small dyeing power are also devoid of colloidal properties, and are converted into true dyes by means of a colloidal mordant, tannin, or an insoluble soap for basic colours, and a metallic hydroxide for acid colours. On the other hand, the azo-dyes of high molecular weight, which dye cotton without a mordant, are sparingly soluble colloids which either separate directly on the fibre or are 'salted out' into it.

Rosaniline hydrochloride, methyl-violet, and methylene-blue have a normal molecular weight in dry alcohol according to the boiling point method, but give values about twice as great in aqueous solution, thus giving an indication of feeble colloidal properties. Thus, rosaniline hydrochloride ($M = 337$) gave 330·5, 325, and 343·6 in alcohol, but 520·6, 589·9, and 617·0 in water; methyl-violet (407·9) gave 403·5, 403·5, and 421·1 in alcohol, but 804·5, 838·7, and 870·4 in water; methylene-blue (319·8) gave 321·4 and 342·7 in alcohol, but 442 in aqueous alcohol, and 321·2, 492·4, and 530·5 in water.

The colloidal nature of tannin is shown by the freezing point of its aqueous solution, which gave $M = 1587$ and 1626, calculated value $= 322$; a diffusion experiment showed a similar result. The metallic hydroxides used as mordants are true colloids, as was shown by Graham, (*Annalen*, 1862, **121**, 1). A colloidal solution containing 3·38 per cent. of ferric hydroxide and 0·098 per cent. ferric chloride was found to freeze within 0·001° per cent. of the freezing point of pure water; on cooling to $-16°$, the hydroxide separated in thin, glistening, dark red-brown flakes. A colloidal solution containing 0·5 per cent. of aluminium hydroxide had exactly the freezing point of pure water; on cooling to $-16°$, the hydroxide separated in very lustrous, transparent films. The insoluble soaps of iron, chromium, aluminium, tin, and antimony are also regarded as colloids, since they are precipitated in "globomorphous" form. It is shown that methylamine palmitate acts like the alkali soaps and gives colloidal solutions; the palmitates, &c., of basic dyes are therefore regarded as insoluble soaps, and colloidal in nature. In support of this, it is shown that rosaniline caproate at first lowers the boiling point of water to a small extent, owing to the volatility of the caproic acid, but on adding a further quantity, a very slight rise is observed, corresponding with a molecular weight of at least 600. The colloidal nature of the tannates of rosaniline, methylene-blue, chrysoidine, auramine, and a number of other mordanted dyes is assumed from the "globomorphous" form in which they are precipitated.

It is further shown that benzopurpurin which dyes cotton directly, gives a value $M = 3000$, the calculated value being 724. On the other hand, "diamine pure blue" gives only $M = 343$, instead of 993. The colloidal nature of these dyes is, however, shown by the fact that whilst rosaniline hydrochloride, methyl-violet, and methylene-blue diffuse through parchment, benzopurpurin, benzazurin, and azo-blue are retained. T. M. L.

Angles of Contact between the Crystal Faces of Alum and its Saturated Solutions. By A. ROTA (*Real. Accad. dei Linc.*, 1898, 7, 125—129).—In order to find a connection between the physical properties of a salt solution and the habit of the crystals separating from that solution, the author has determined the angle of contact between octahedral and cubic alum crystals and their saturated solutions. On allowing the solvent to evaporate from a solution of pure alum in distilled water, octahedral crystals are deposited; and by heating powdered alunite at 300—400°, and extracting with water the reddish substance thus produced, a solution is obtained which on purification yields cubic alum crystals. When the small crystals obtained by the spontaneous evaporation of the solutions were suspended in their respective mother liquors and allowed to grow, uneven faces giving irregular reflections were the result; so that before using the crystals, the faces were carefully polished, care being taken to keep the polished faces parallel to the original face. The method of measurement employed was that devised by Quincke, in which a drop of the liquid is placed on a plane surface of the solid and the angle between the light-ray reflected from the last element of the liquid and that from the surface of the solid is read off on a goniometer. The angles of contact between an octahedral face and the octahedral and cubic solutions respectively were found to have the mean values 10° 16′ and 15° 13′, and the values for a cubic face and the cubic and octahedral solutions respectively, 10° 22′ and 15° 36′. From this, it is concluded that from any solution that form crystallises whose faces present the least angle of contact with the solution. T. H. P.

Vacuum Regulator for Distillations Under Reduced Pressure. By VICTOR AUGER (*Bull. Soc. Chim.*, 1898, **19**, [iii], 731—733).—This apparatus consists of a reservoir separated into two parts by a horizontal indiarubber membrane, each enclosure being separately connected with the vacuum pump. The lower enclosure is connected with the distillation apparatus and contains the manometer; it is also fitted with an automatic arrangement for introducing variable quantities of air into the apparatus. This consists of a hollow nickel tube open at both ends, which is inserted horizontally into the reservoir by means of a flexible rubber stopper. The end of the tube within the apparatus is flattened out into a disc which is placed immediately below the indiarubber membrane; the outer end is bent downwards at right angles, and is pressed against an indiarubber pad by means of a counterpoise. At the commencement of the operation, the pressure in both compartments of the reservoir is diminished to the required extent, and the upper enclosure is then cut off from the pump, and as the pressure in the lower compartment continues to fall the membrane becomes convex on its lower side and presses down the disc of the hollow nickel tube. The outer end of this tube is consequently lifted off its indiarubber pad, and a certain quantity of air rushes into the lower receptacle, the pressures on each side of the diaphragm are equalised, and the membrane and nickel lever resume their original positions. This automatic introduction of air is repeated whenever the pressure in the lower receptacle falls below that in the upper; the apparatus maintains a constant pressure as long as the volume of gas removed by the pump exceeds that generated in the distillation. G. T. M.

Modifications of the Geissler Pump. By GIOVANNI GUGLIELMO (*Real. Accad. dei Linc.*, 1898, 7, 240—249).—The author describes further improvements in the modified form of Geissler's pump already devised by him (Abstr., 1891, 524). The long, straight tube of the Geissler pump is replaced by a flexible rubber tube, the height of the instrument thus being diminished. To economise mercury and facilitate the manufacture of the pump, the bulbs are made of small capacity. The pressure of the rarefied air is measured by determining the pressure necessary to compress all the air in the receiver into the small capillary boring of the stopcock, the relation between the two pressures being previously found. T. H. P.

Inorganic Chemistry.

Molecular Complexity of Liquid Hydrogen. By WILHELM VAUBEL (*J. pr. Chem.*, 1899, [ii], **59**, 246—247).—The author corrects a statement made in a previous communication (Abstr., 1898, ii, 503), in which the molecular complexity of liquid hydrogen is given as 3·8. Using the boiling point given by Dewar (– 238°) instead of that previously employed (– 243°) for hydrogen, the following constants are obtained :

Molecular complexity of gaseous hydrogen = 2
„ „ „ liquid „ = 5·2
Density of liquid hydrogen ... ... = 0·07
Critical pressure (probably) ... ... = 15 atmos.

F. H. N.

The Flame of Hydrogen. By FRÉDÉRIC SCHLAGDENHAUFFEN and PAGEL (*Compt. rend.*, 1899, **128**, 1170—1172).—The violet-blue colour observed when an impure hydrogen flame is allowed to impinge on a cold surface is due to the presence of selenium, and not, as Salet supposed, to sulphur. A large proportion of the selenium originally present in the materials from which the gas was prepared remains in the insoluble black residue. C. H. B.

Ratio of the Atomic Weights of Hydrogen and Oxygen. By ANATOLE LEDUC (*Compt. rend.*, 1899, **128**, 1158—1159).—The author's experiments on the synthesis of water led to the number $O = 15·88$ when $H = 1$, but his determination of the densities of oxygen and hydrogen led to the result $O = 15·868$, and to the conclusion that when 2 vols. of hydrogen and 1 vol. of oxygen are mixed, there is an increase of pressure of about 0·19 mm. This agrees with the observation of Berthelot and Sacerdote (this vol., ii, 404). Assuming that this increase of pressure is only 0·15 mm., the volumetric composition of water is given by the equation $x \times 0·06948 + (1 - x)\ 1·10523 = 1·0002 \times 0·41423$ and $2(1 = x)\ 1·10523/x \times 0·06948 = 15·878$, a value which agrees very closely with those given above. C. H. B.

The Blue Colour of Water. By WALTHÈRE SPRING (*Rec. Trav. Chim.*, 1899, **18**, 1—8).—As the result of a series of experiments, the author concludes that the blue colour is one of the properties of water itself, and cannot be caused by particles suspended in it, as these would reflect waves of light of all colours with equal facility. F. H. N.

Action of a Hard Water on Metals. By JAMES LEWIS HOWE and J. L. MORRISON (*J. Amer. Chem. Soc.*, 1899, **21**, 422—425).—A sample of tap-water, containing an excess of carbonic anhydride and a relatively large proportion of magnesia, along with little sulphate and only a trace of chlorine, was allowed to act on various metals for a period of four months ; comparative experiments were made, using distilled water. It is found that this hard water acts readily on iron if exposed to the air, but does not affect aluminium or nickel. Zinc is very susceptible to attack, and brass is quickly corroded, the zinc being dissolved out, but the copper left intact. T. H. P.

Sodium Aluminate as a means for the Removal of Lime and Suspended Matters from Water for use in Boilers. By Charles F. Mabery and Edwin B. Baltzley (*J. Amer. Chem. Soc.*, 1899, **21**, 23—27).—The use of sodium aluminate is recommended for softening and clarifying water for boilers. This compound may be prepared by adding the proper amount of sodium hydroxide to a solution of aluminium sulphate, or by fusing clay with soda-ash; a definite quantity of it is well mixed with the water, which is then allowed to settle for from 12 to 24 hours. The precipitation of the acid calcium carbonate takes place according to the equation $CaH_2(CO_3)_2 + Na_2Al_2O_4 + 2H_2O = CaCO_3 + 2Al(OH)_3 + Na_2CO_3$; the sodium carbonate produced decomposes the calcium sulphate in the water. The reactions with magnesium carbonate and sulphate are similar. The precipitated alumina causes any turbidity to rapidly settle, and experiments show that very hard and muddy waters can be successfully treated by this method. Comparative tests with sodium aluminate and sodium hydroxide show that the latter does not precipitate any of the magnesia from water, and, further, only removes about one-half as much lime as the former reagent. T. H. P.

Stability of Solutions of Hypochlorous Acid in Presence of Alkalis. By Julius Thomsen (*J. pr. Chem.*, 1899, [ii], **59**, 244—246).—Solutions of hypochlorous acid containing 1 mol. of acid to 200 mols. of water, and more dilute solutions, remain unaltered for several days, and solutions of the acid in excess of sodium hydroxide are equally stable. If, on the other hand, the acid is present in excess, decomposition soon takes place. These results agree with those obtained by Förster and Jorre (this vol., ii, 278). F. H. N.

Colour of Compounds of Bromine and Iodine. By J. H. Kastle (*Amer. Chem. J.*, 1899, **21**, 398—413).—The relationship of the halogens in regard to their power of producing coloured compounds is discussed, and it is shown that, in this respect, they follow the usual order, beginning with fluorine and culminating in iodine. The colour of their compounds is intimately connected with their stability, those compounds which are most highly coloured being, as a rule, most prone to decomposition, and, as, for example, in the case of phosphorus pentabromide, the colour deepens as the temperature more nearly attains that of recognised dissociation; it is suggested that even in the solid state these coloured halogen compounds may be slightly dissociated, the colour being due to greater or smaller quantities of free halogen, and it is only necessary to assume that the amount of dissociation is excessively minute, 0·000066045 gram of iodine being sufficient to impart a distinct yellow colour to 20 c.c. of water. Examples are cited, both of organic and inorganic compounds, to show how this assumption serves to explain the gradation in properties, both of groups of halogen compounds and of the alterations in colour of the individuals with rise or fall in temperature, and also the relationship between colour and stability. Lead bromide, for instance, although white at ordinary temperatures, becomes yellow when heated, and its colour approaches more closely to that of the iodide as the temperature rises.

A. L.

Iodine in Sea Water. By ARMAND GAUTIER (*Compt. rend.*, 1899, **128**, 1069—1075).—The following method permits of the detection and estimation of 0·2 milligram of iodine per litre. The solution is treated with potassium carbonate as long as a precipitate is produced, rendered alkaline with caustic potash, and evaporated to the crystallising point. The whole is thoroughly mixed with 83 per cent. alcohol, the magma produced is filtered, and the filtrate evaporated to dryness. The residue is acidified with dilute sulphuric acid, neutralised with caustic potash, treated with 90 per cent. alcohol, and filtered. The filtrate contains the whole of the bromine and iodine in the state of bromides and iodides respectively; it is distilled with a concentrated solution of potassium dichromate, the liberated iodine received in a solution of caustic potash, and estimated by the author's method (*Compt. rend.*, 1899, **128**, 644). When this process was applied to 5 litres of water taken from the surface of the open sea, metallic iodides could not be detected, and if present, cannot exceed 0·02 milligram per litre in amount. The residue left on treating sea water with dilute alcohol is mixed with caustic potash and fused in a nickel crucible, in order to decompose organic substances; the residue, after cooling with ice, is acidified with cold dilute sulphuric acid, and rendered feebly alkaline with caustic potash; the quantity of iodine present, estimated by the above process, amounts to 2·4 milligrams per litre. On filtering 5 litres of sea water through a filter of porous earthenware, a slimy residue is obtained which contains, besides animal and vegetable refuse, many species of rotifersand diatoms; it amounts to 10 milligrams per litre, and when fused with caustic potash and treated in the manner described above yields 0·52 milligram of iodine. The residue obtained on evaporating the filtrate to dryness is also fused with potash; the iodine present amounts to 1·8 milligrams per litre. These results indicate that water taken from the surface of the sea contains no metallic iodides, and that the whole of the iodine exists in organic compounds, four-fifths being contained in soluble compounds and the remainder forming part of the substance of the infusoria inhabiting the superficial layers of the ocean.

G. T. M.

Oxidising Action of Alkali Periodates. By E. PÉCHARD (*Compt. rend.*, 1899, **128**, 1101—1104).—The sodium periodate, $NaIO_4$, is acid to litmus, but neutral to methyl-orange, so that the salt may be estimated by titration with sulphuric acid using the latter indicator. The iodates and periodates are generally supposed to have similar oxidising properties, but in some cases they exhibit very marked differences. Sodium periodate reacts like a compound of the iodate and active oxygen; it gives all the reactions produced by ozone, tarnishing silver, oxidising thallous oxide, and decolorising indigo.

Iodates may be estimated by their oxidising action on oxalic acid in presence of sulphuric acid; periodates oxidise this reagent with extreme slowness, the action being comparable with that of ozone on the same substance. On adding manganous sulphate to the solution, the periodate, like ozone, oxidises the manganous salt to manganese dioxide, whereon this substance and the iodate which results from the action are simultaneously reduced by the oxalic acid. When a periodate is added to an acid solution of ferrous sulphate, one atom of oxygen from the molecule of periodate at once oxidises a portion of the iron salt; the iodate produced has an oxidising action on ferrous salts in acid solutions, but the reaction proceeds very slowly, so that it is possible by a rapid titration to determine the active oxygen derived from the periodate. In alkaline solutions of ferrous salts, the active oxygen of the periodates alone reacts; iodates have no oxidising effect under these conditions. Similar results are obtained with solutions of sodium arsenite, and all these reactions may be employed in estimating periodates. A solution of disodium periodate, $Na_2H_3IO_6$, slowly decomposes hydrogen peroxide, its action being similar to that of caustic soda. A neutral solution of the mono-sodium salt decomposes hydrogen peroxide; oxygen is evolved, one-half of which is derived from the periodate and the other half from the peroxide, $NaIO_4 + H_2O_2 = NaIO_3 + H_2O + O_2$; when the solution is acidified with sulphuric acid both oxygen and iodine are liberated in accordance with the following equation: $2HIO_4 + 7H_2O_2 = 8H_2O + I_2 + 7O_2$.

These results indicate that in alkaline and neutral solutions (methyl-orange being employed as indicator) the periodates have an oxidising action which is not exhibited by the iodates and perchlorates, and it therefore appears probable that the periodates differ in constitution from the corresponding salts of these series. G. T. M.

Properties of Liquid Sulphurous Anhydride. By A. LANGE (*Zeit. angew. Chem.*, 1899, 275—277, 300—305).—The specific gravity and the coefficient of expansion of liquid sulphurous anhydride were determined at temperatures from 13·3° to 92·3° by heating a known weight of the liquid in an iron vessel of known volume and connected with a manometer until the liquid just filled the vessel, this point being accurately indicated by the sudden and very rapid rise of pressure. Tables showing the specific gravity and coefficient of expansion of the anhydride from −50° to 100° are given. From determinations of the pressure produced by heating the vessel a few degrees beyond the temperature at which it becomes just filled with liquid, and the coefficient of expansion at this temperature, the coefficient of compressibility was calculated; it increases from 0·000132 at 16·3° to 0·000467 at 92·1°. A sample of ordinary commercial liquid sulphurous anhydride which contained 0·7 per cent. of water, attacked iron at temperatures above 70°, forming a solid crust of ferrous sulphite and thiosulphate, but the metal was not affected, or only very slightly, by the pure anhydrous substance. The importance of these observations in regard to the storing of the liquid in iron cylinders and its use in freezing machines is pointed out. E. W. W.

Preparation of Tellurium. By VICTOR LENHER (*J. Amer. Chem., Soc.*, 1899, 21, 347—351).—On treating electrolytic slimes with concentrated hydrochloric acid, filtering through asbestos, and passing sulphurous anhydride into the clear filtrate, it is found that, contrary to

Keller's statement (Abstr., 1898, ii, 638), the tellurium is precipitated as well as the selenium.

When tellurium dioxide is heated with aluminium or magnesium, a violent reaction takes place; with aluminium, the telluride is formed, but with magnesium the action is so energetic as to prevent any of the products being collected. On heating the oxide with dry glucose or asphalte, a mass of coke is produced, from which it is difficult to obtain the tellurium; with oxalic acid, however, the metal readily fuses into a button.

Tellurium is precipitated when an aqueous solution of an alkali telluride is warmed with either grape sugar or cane sugar; in the latter case, an intermediate formation of purple alkali telluride takes place. T. H. P.

Formation of Azoimide. By SIMEON TANATAR (*Ber.*, 1899, **32**, 1399—1400).—A benzene solution of nitrogen chloride containing about 3·3 per cent. of the latter reacts with an aqueous solution of hydrazine sulphate to form azoimide, as much as 36 per cent. of the theoretical yield being obtained when the two solutions are shaken together and aqueous caustic soda added at intervals. With the exception of the method proposed by Wislicenus, this is the best process for the preparation of the acid. A. H.

Preparation of Fuming Nitric Acid. By LUDWIG VANINO (*Ber.*, 1899, **32**, 1392—1393).—When formaldehyde is added to concentrated nitric acid, a rapid evolution of nitric peroxide occurs, but the exact quantitative relations have not yet been determined. Fuming nitric acid may be prepared by passing the gases thus evolved into nitric acid, or more directly by adding the solid form of paraformaldehyde to nitric acid, no organic products remaining in the acid. The presence of hydrochloric acid or of chlorine greatly hinders the reaction, whilst hydrogen peroxide appears to prevent it completely.

A. H.

Behaviour of Nitric Peroxide with Sulphuric Acid and Nitric Acid. By GEORG LUNGE and E. WEINTRAUB (*Zeit. angew. Chem.*, 1899, 393—402, 417—424).—From three series of experiments in which sulphuric acid of various strengths was treated with (*a*) nitrosylsulphuric acid, (*b*) nitric peroxide, and (*c*) nitric acid and nitric peroxide, and a fourth in which nitric acid was mixed with nitrosylsulphuric acid, the following conclusions were reached. (1) When nitric peroxide is mixed with sulphuric acid, nitrosylsulphuric acid and nitric acid are formed, but since the reverse change may also occur, the mixture contains all four compounds, and a state of equilibrium is attained. (2) When sulphuric acid of sp. gr. 1·84 is employed, the conversion of nitric peroxide into nitrosylsulphuric and nitric acids is the main reaction, the reverse reaction only coming into prominence when the quantity of sulphuric acid is small. (3) The affinity of sulphuric acid for nitric peroxide decreases rapidly as the amount of water is increased, hence with sulphuric acid of sp. gr. 1·65 a large proportion of the peroxide remains uncombined, although the quantity of nitric acid present is small. (4) In the manufacture of sulphuric acid, the nitric peroxide is almost completely converted into nitrosylsulphuric acid and nitric acid, owing to the presence of a large excess of sulphuric acid, and similarly, nitrous fumes are completely absorbed by a large excess of sulphuric acid. E. W. W.

Action of Metals on Nitric Acid. By Paul C. Freer and George O. Higley (*Amer. Chem. J.*, 1899, **21**, 377—392. Compare Abstr., 1893, ii, 272, &c.).—The action of pure iron wire on nitric acid of various strengths was examined. With dilute acid, the products were nitric peroxide, nitric oxide, nitrous oxide, nitrogen, and ammonia, in proportions which varied both with the concentration and the amount of acid used. The results obtained with dilute acid (sp. gr. 1·20—1·03) were not in harmony with those of Acworth and Armstrong (Trans., 1877, **32**, 79), owing to the fact that these workers made no determinations of the nitric peroxide and ammonia which were formed.

Silver, copper, and iron have a similar action on strong nitric acid (sp. gr. 1·40—1·35), the products being nitric peroxide and nitric oxide, and the curves obtained for silver and copper were practically identical. The specific action of these three metals is only observed when the dilution is considerable, hence the non-ionised acid acts merely as an oxidising agent ; in this case, nitric peroxide is probably the first product, and nitric oxide is obtained only as the result of a secondary change due to the action of water on the peroxide, this view being confirmed by the observation that the relative proportions of these two gases vary with the mass of the acid present.

Silver and copper have substantially the same action on nitric acid of medium strength (sp. gr. 1·2), giving 10 per cent. of nitric peroxide and 90 per cent. of nitric oxide; with lead, however, the products are nitrous oxide (40 per cent.), nitric oxide (50 per cent.), and nitric peroxide (only 2·5 per cent.). The metals examined may therefore be ranged in the following order in regard to their action on dilute nitric acid, beginning with the weakest: silver, copper, lead, and iron, but in stronger acid, lead acts more energetically than iron.

In order to throw light on the mode of action of metals on nitric acid, the liquid was submitted to electrolysis, cathodes of platinum, silver, lead, and copper of equal area being employed. It is concluded that the activity of electrolytic hydrogen depends on the electrode on the surface of which it is liberated ; that electrolytic hydrogen with cathodes of copper or silver effects the reduction of the acid in proportion to the current density ; that nitric acid of sp. gr. 1·05, when electrolysed with cathodes of silver or lead with equal current densities yields the same products, namely, nitrogen and ammonia in about the same proportions, but when these metals dissolve in acid of this strength, the products are widely different, both qualitatively and quantitatively.

Lead, which reduced nitric acid of sp. gr. 1·05 much more completely than does copper yielding about five times as much nitric oxide when made the cathode of an electrolytic cell, has a far feebler action, and yields only about one-third of the amount of ammonia given by the latter.

Since, in the electrolysis of nitric acid with a constant current the action of metal ions is excluded, and the reduction must be effected by hydrogen ions in contact with the metal, it follows that the widely different effects observed on dissolving metals in nitric acid must be attributed to the different deoxidising properties of the metals themselves, and not to the effect of nascent hydrogen. A. L.

Dissociation of Phosphorus Pentabromide in Solution in Organic Solvents. By J. H. KASTLE and W. A. BEATTY (*Amer. Chem. J.*, 1899, **21**, 392—398).—Many bromine compounds of the most diverse types are yellow in the solid state, and dissolve in inert media to form solutions which have colours closely resembling those of bromine solutions. The idea suggested itself that in such solutions the compounds were either wholly or partly dissociated or decomposed. Such a compound is found in phosphorus pentabromide, which is readily obtained in a pure state as yellow, rhombic prisms, which, when heated in a sealed tube, melt, forming a dark red liquid; this, when further heated, is dissociated, giving dark red vapours of bromine; it forms dark red solutions in carbon bisulphide, chloroform, or carbon tetrachloride, and these have been subjected to colorimetric comparisons with solutions of bromine in the same liquids.

The results appear to show that in carbon bisulphide the compound is completely dissociated into phosphorus tribromide and free bromine at dilutions varying between *N*/100 and *N*/1000, and that it is not a non-reversible decomposition is indicated by the fact that the red and yellow modifications of the pentabromide may be obtained on evaporation. Further support is obtained for this view from the fact that the addition of tribromide to the solutions causes them to become lighter in colour, and that addition of carbon bisulphide to the solution of the pentabromide in tribromide causes a deepening of the colour.

In carbon tetrachloride, the pentabromide appears to be dissociated to the extent of 90 per cent. at dilutions between *N*/40 and *N*/400; no sufficient reason for the difference in behaviour of carbon bisulphide and carbon tetrachloride has as yet been found, but it is thought that it may be connected with the greater solubility of the substance in the former liquid. A. L.

Preparation of Graphitic Acid. II. By LUDWIG STAUDENMAIER (*Ber.*, 1899, **32**, 1394—1399. Compare Abstr., 1898, ii, 472).—A small amount of graphitic acid can be rapidly prepared to illustrate a lecture by bringing a mixture of carefully prepared graphite with 50—60 times its weight of potassium chlorate into a mixture of pure sulphuric acid with half its volume of nitric acid, the whole being gradually heated up to 80°. The green intermediate product is thus formed, and the mass is then poured into a concentrated solution of potassium permanganate and heated until the whole of the latter is decomposed. The graphitic acid is then left as an insoluble, yellow mass. Intumescent graphite (Ceylon graphite) must be previously brought along with an equal weight of potassium chlorate, into a mixture of nitric and sulphuric acids, gradually heated to 100°, and then washed and strongly heated; the resulting voluminous mass is then washed and all the lighter portions again heated strongly, after which it is submitted to the final oxidation. Non-intumescent varieties of graphite, such as that from Bohemia, are simply fused with caustic potash, washed, and finely ground.

Large amounts of graphitic acid may be prepared in a very similar manner by simply allowing the graphite to remain for some days at atmospheric temperature in the mixture of acids, potassium chlorate being added at intervals until the green compound is formed. As much as 250 grams of graphite have been oxidised in one operation by this method, which is quite free from danger, provided that the mass is occasionally stirred, in order to prevent any great rise of temperature or any accumulation of chlorine peroxide. A. H.

Percarbonates. By SIMEON M. TANATAR (*Ber.*, 1899, **32**, 1544—1546).—Sodium percarbonate, $Na_2CO_4 + 1\frac{1}{2}H_2O$, is precipitated as a fine, crystalline powder on adding alcohol (3 vols.) to a mixture of sodium carbonate (7·5 grams) and hydrogen peroxide (100 grams) which has stood for from 5 to 10 minutes. Like all similarly constituted compounds, it gradually decomposes in aqueous solution, forming hydrogen peroxide and sodium carbonate; with acids, carbonic anhydride is evolved, and the solution contains hydrogen peroxide which can be extracted with ether; halogen acids are oxidised with separation of the halogen; when heated at 100°, oxygen is evolved, unaccompanied by carbonic anhydride. The heat of decomposition of the salt, determined by adding to its $N/10$ solution a $N/10$ solution of nitric acid, gave 7·210—7·260 Cal., the heat of decomposition of sodium carbonate being 5·33 Cal. The salt dissolves in water with a heat absorption of about 3·9 Cal.

By employing twice as much hydrogen peroxide in the above reaction, the salt $Na_2CO_4,\frac{1}{2}H_2O_2 + H_2O$ is obtained.

Potassium percarbonate has not as yet been obtained in a pure condition.

Whether these compounds are in reality salts of percarbonic acid, or whether they are merely double compounds of the carbonate and hydrogen peroxide in which the latter plays the part of water of crystallisation is, in the author's opinion, still open to question, although their thermochemical behaviour and the non-formation of similar compounds from other salts containing water of crystallisation seems to favour the former view. J. F. T.

Probable Presence of Coronium and New Elements in the Solfatara of Pozzuoli and Vesuvius. By RAFFAELE NASINI, FRANCESCO ANDERLINI, and ROBERTO SALVADORI (*Real. Accad. dei Linc.*, 1898, **7**, 73—74).—The gas emitted from the solfatara of Pozzuoli, besides containing argon, shows in its spectrum a brilliant line having the wave-length 531·5—531·6; this corresponds exactly with the coronal line 1474 *K* belonging to an undiscovered element, coronium, which is lighter than hydrogen, and has never before been detected in any terrestrial body. Also lines with the following wave-lengths are present: 653·5, 595·5, and 536·2; the line 595·5 is found in the spectra of gases from some of the Vesuvius fumaroles, and, in addition, the lines 769·5, 631·8, 572·5, 536·5, and 441·5. None of these belong either to the spectrum of argon or that of helium; some of them coincide with or approximate to unimportant lines of the spectra of iron, potassium, titanium, and mercury, but the presence in the gas of these elements is very improbable under the experimental conditions employed. The line of 572·5 wave-length, which is almost coincident with a line of the nitrogen spectrum, cannot be attributed to that element, since of all the nitrogen lines it is the only one visible. The authors are of opinion that besides coronium, other new gaseous elements are present. T. H. P.

New Method of Preparing Cæsium. By HUGO ERDMANN and ALBERT E. MENKE (*J. Amer. Chem. Soc.*, 1899, **21**, 259—262).—Cæsium alum is converted by means of baryta into the sulphate and thence into the hydroxide. The hydroxide is heated with magnesium in an iron tube in a current of hydrogen gas, and the cæsium is collected under paraffin in almost a theoretical yield. T. M. L.

Specific Gravity of Cæsium. By ALBERT E. MENKE (*J. Amer. Chem. Soc.*, 1899, **21**, 420—421).—By weighing highly purified cæsium in hydrogen and then under paraffin, a mean value of 2·40003 is found for its specific gravity. This number changes the atomic volume from 70·6, the usually accepted value, to 55·3, which is less than that of rubidium. The accuracy of the value adopted for the specific gravity of the latter metal is questioned. The results obtained confirm Beketoff's numbers. T. H. P.

Luminous Phenomena Produced by Ammonium Salt and Fused Potassium Nitrite. By DONATO TOMMASI (*Compt. rend.*, 1899, **128**, 1107).—When powdered ammonium nitrate is scattered over fused potassium nitrate, the whole surface of the molten salt becomes studded with phosphorescent particles; if a single crystal of the ammonium salt be added, it takes the form of an incandescent globule surrounded by a rotating phosphorescent ring; after a few seconds the globule bursts, giving rise to a violet flame. Ammonium chloride and sulphate behave similarly, but the luminous effect is less pronounced. G. T. M.

Silver Peroxysulphate. By EDUARD MULDER (*Chem. Centr.*, 1899, i, 16; from *Verh. Kon. Akad. Wetensch. Amsterdam*, 1898).—Silver peroxysulphate, $5Ag_2O_2,2Ag_2SO_7$, is obtained as a black, crystalline precipitate by electrolysing a half-saturated solution of silver sulphate, the formation of free sulphuric acid which decomposes this compound being avoided by continually neutralising the liquid with silver carbonate. The composition of the compound was ascertained by boiling it with water, estimating the quantity of oxygen liberated by the decomposition of the sulphate Ag_2SO_7, and determining the residual peroxide by dissolving in nitric acid. E. W. W.

Caustic Lime in Ancient Masonry. By GEORGES ARTH (*Bull. Soc. Chim.*, 1898, **19**, [iii], 717—718).—A portion of the old walls of Nancy built in the 17th century was found to contain in its interior several small cavities filled with hydrated lime. One fragment weighing 40 grams contained 57·5 per cent. of calcium hydroxide and only a trace of calcium carbonate. G. T. M.

Action of Manganese in Producing Phosphorescence of Strontium Sulphide. By José R. Mourelo (*Compt. rend.*, 1899, **128**, 1239—1241).—Strontium sulphide, produced by igniting a mixture of pure strontium carbonate with flowers of sulphur and oxide of manganese, prepared by heating the carbonate, are not phosphorescent separately, but when a mixture of strontium carbonate (100 pts.), flowers of sulphur (33 pts.), and manganese carbonate (0·15 pt.) is heated to redness, a greyish-white mass is obtained, which, after a short exposure to diffused daylight, exhibits a persistent green phosphorescence, the colour of which differs markedly from the yellowish-green tint obtained with phosphorescent strontium sulphide. The most intense effect is obtained by adding sodium carbonate (1·4 pts.) and fused sodium chloride (0·85 pt.) to the above ingredients and igniting the mixture at bright red heat for 3 hours; the cooled product, after exposure to light, phosphoresces strongly, the shade of green exhibited being quite different from that developed when basic bismuth nitrate is the active agent. G. T. M.

Magnesium Phosphide. By Henri Gautier (*Compt. rend.*, 1899, **128**, 1167—1169).—Magnesium phosphide, Mg_3P_2, can be obtained by the direct combination of phosphorus vapour and magnesium in an atmosphere of hydrogen, and forms small, brilliant, dark greenish-grey crystals, which alter rapidly in moist air, and can only be kept in sealed tubes. Dry air and oxygen are without action at the ordinary temperature, but the phosphide burns in oxygen at a dull red heat, and is converted into magnesium phosphate. The phosphide burns brilliantly when heated in chlorine, and also in bromine and iodine vapours at somewhat higher temperatures. Hydrochloric acid decomposes it with liberation of hydrogen phosphide; concentrated sulphuric acid slowly converts it into magnesium sulphate and phosphoric acid; nitric acid oxidises it with incandescence, forming magnesium nitrate and phosphoric acid. Water very readily decomposes the phosphide, with production of magnesium hydroxide and pure hydrogen phosphide. C. H. B.

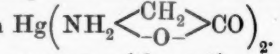
Halogen Lead Salts. By Victor Thomas (*Compt. rend.*, 1899, **128**, 1234—1236. Compare Abstr., 1898, ii, 585, and this vol., ii, 278).—A *lead chlorobromide* having the composition $3PbCl_2,PbBr_2$ is produced by dissolving lead chloride and potassium bromide in water. The double salt is decomposed by water into its components; hydrochloric acid converts it into lead chloride, and hydrobromic acid into the bromide. When the chloriodide, PbICl, is treated with bromine, it gives rise to a *chlorobromide*, PbBrCl, which is obtained in colourless needles; its properties resemble those of the preceding double salt, and it is converted into lead iodide by boiling with hydriodic acid. Definite chlorobromides could not be isolated from mixtures of hydrobromic acid and lead chloride, hydrochloric acid and lead bromide, and lead bromide and chloride. A *lead bromiodide* having the composition $3PbBr_2,PbI_2$ is obtained by saturating a solution of lead bromide with lead iodide and subsequently cooling; the same compound is produced when lead bromide and potassium iodide are dissolved in water and the solution kept at 50—65°; as the temperature falls below 50°, the amount of admixed lead bromide increases, whilst above 65° the double salt is contaminated with lead iodide. G. T. M.

Apparatus for the Purification of Mercury. By WILHELM PALMAER (*Ber.*, 1899, **32**, 1391—1392).—Mercury is allowed to fall through dilute nitric acid in very fine streams, which are obtained by causing the metal to leave the vessel containing it by way of a number of long, narrow depressions, about 0·25 mm. in breadth, cut into the surface of a glass rod which is ground into the narrow lower extremity of the mercury reservoir. A. H.

Displacement of Mercury by Hydrogen. By ALBERT COLSON (*Compt. rend.*, 1899, **128**, 1104—1106).—When dried, powdered, yellow mercuric oxide is heated at 100° in tubes filled with hydrogen, it is reduced to the metal, the amount of hydrogen absorbed being directly proportional to the quantity of oxide, and to the time of the experiment. The rate of absorption is proportional to the cube root of the pressure, and is five times greater for the yellow oxide than for the red modification; in other respects, the results obtained with the two varieties of mercuric oxide are quite comparable. Hydrogen has no reducing action on mercurous oxide at 100°; on the other hand, this substance at the same temperature rapidly absorbs oxygen.

Mercuric chloride is not acted on by hydrogen at 100°, but the corresponding nitrate and sulphate are readily reduced, the latter oxy-salt being converted into mercurous sulphate and sulphuric acid. This reaction is slow at first, but afterwards proceeds more rapidly, the presence of free sulphuric acid facilitating the reduction. Sulphurous anhydride is simultaneously produced, and is probably derived from the mercurous sulphate, $Hg_2SO_4 + H_2 = Hg_2O + SO_2 + H_2O$; the oxide produced combines with some of the free sulphuric acid and regenerates mercurous sulphate.

Mercurous nitrate, when heated at 100° with hydrogen, decomposes in the following manner: $Hg_2(NO_3)_2 + 2H_2 = 2NO + 2HgO + 2H_2O$; the hydrogen reduces the acid radicle, and at the same time brings about an oxidation of the mercury radicle from the *ous* to the *ic* condition. At 100°, mercurous nitrate absorbs oxygen, giving rise to mercuric compounds; on the other hand, mercuric salts at the same temperature are easily reduced by hydrogen, and water is produced; it may therefore be inferred that the presence of mercuric salts lowers considerably the temperature of combination of hydrogen and oxygen.
G. T. M.

Chemistry of Mercury. By HEINRICH LEY and H. KISSEL (*Ber.*, 1899, **32**, 1357—1368).—The only compounds of bivalent mercury which show a tendency to electrolytic dissociation are those in which the metal is directly united with oxygen. Thus the chloride and bromide possess a very low molecular conductivity, and that of the cyanide is even lower. In the same way, mercury acetamide and mercury succinimide also have a very low conductivity, and in aqueous solution act as weak bases which are decomposed by hydrochloric acid. The acetamide compound can, in fact, be titrated with hydrochloric acid in presence of methyl-orange. Mercury glycocine closely resembles the acetamide compound in its behaviour, and has therefore probably the constitution  $Hg\left(NH_2<\begin{matrix}CH_2\\-O-\end{matrix}>CO\right)_2$.

The salts of mercury with acetic, propionic, glycollic, and monochloracetic acids undergo a considerable hydrolytic decomposition in aqueous solution, which is rendered evident by the agreement of their conductivities with those of the corresponding acids, and by the fact that the hydrogen ions present are capable of bringing about the inversion of sugar, &c. Mercury perchlorate also undergoes hydrolytic decomposition in solution. This behaviour of the mercury compounds may be utilised for ascertaining the constitution of various derivatives of the metal. Mercuric nitrite has the conductivity of an oxygen compound of mercury, the value for the conductivity showing that nitrous acid must be of about the same strength as acetic acid. The mercury derivative of methylnitramine crystallises in hard, colourless needles, and in solution has the properties of an oxygen compound of mercury, so that its constitution is most probably $Hg(O \cdot NMe \cdot ON)_2$.

Mercuric fulminate behaves electrolytically in an analogous manner to the cyanide, and it is, therefore, probably not an oxygen derivative as supposed by Nef. The cyanide also resembles the fulminate in the fact that it is readily converted by sodium amalgam into the sodium salt, which is strongly dissociated.

Mercury nitroform is colourless in the solid form and yields colourless solutions in ether, benzene, &c., whilst its solution in water is yellow and has a fairly high conductivity, which indicates that both electrolytic dissociation and hydrolytic decomposition have occurred. It therefore appears that both nitroform itself and its mercury derivative in the solid form are true nitro-compounds, whereas in solution they both have the isomeric structure. A. H.

Formation of Red Mercuric Sulphide in the Wet Way. By Ugo Alvisi (*Real. Accad. dei Linc.*, 1898, **7**, 97—98).—When the following substances are suspended in solutions of yellow ammonium sulphide, they are converted into red mercuric sulphide: (1) $Hg(EtS)_2$, on shaking with the ammonium sulphide solution, this compound is immediately changed into the sulphide; (2) $HgCl \cdot EtS$, this requires a longer time, becoming first black and then red; (3) $HgCl_2,Et_2S$ and (4) Hg_2Cl_2 are converted very slowly into the sulphide, passing first into an intermediate, black, crystalline compound; the reaction, which takes place in the cold, is accompanied by the separation of ethylic sulphide.

On passing hydrogen sulphide through boiling water in which mercury mercaptide is suspended, the mercaptide assumes first a reddish colour, then becomes black, and finally reddish again, large quantities of mercaptan being meanwhile evolved. Analysis of the red compound shows it to be mercuric sulphide, which is also obtained by passing hydrogen sulphide into a hot acidified solution of mercury mercaptide in alcohol. T. H. P.

A Crystallised Double Perceric Carbonate. By André Job (*Compt. rend.*, 1899, **128**, 1098—1099. Compare this vol., ii, 291 and 334).—A solution of ceric peroxide in potassium carbonate containing carbonic acid may be kept for several months without undergoing alteration; by spontaneous evaporation at ordinary temperature, it deposits the double carbonate, $Ce_2O_3(CO_3)_3,4K_2CO_3 + 12H_2O$, which separates in blood-red crystals. This substance, when dissolved in dilute sulphuric acid, yields carbonic anhydride, oxygen, hydrogen peroxide, and potassium cerous sulphate. A brown liquid having all the characters of a solution of a perceric salt is obtained on dissolving the double carbonate in a dilute solution of potassium carbonate. The crystals of the double carbonate become anhydrous when heated to 110°, but undergo no further decomposition when the temperature is raised to 200°; at 210°, evolution of oxygen commences, and as the temperature rises, the rate of evolution increases; at 300°, carbonic anhydride is liberated, and the decomposition is complete in 1 hour at 360°; the residue then consists of a yellow ceric potassium carbonate having the composition $Ce_2O_3,CO_3,4K_2CO_3$. The double perceric carbonate is also produced, together with the yellow ceric salt by agitating a solution of cerous nitrate and potassium carbonate in the presence of atmospheric oxygen. G. T. M.

Impurities in Aluminium. By ADOLPHE MINET (*Compt. rend.*, 1899, **128**, 1163—1167),—The aluminium now made is of a relatively high degree of purity, the iron and silicon, which together amount to considerably less than 1 per cent., being mainly derived from the electrodes or from the walls of the furnace. One of the best forms of furnace is a parallelopiped of iron lined with carbon, and provided with an outlet below the cathode for the continuous removal of the aluminium. The anode and cathode are quite independent of the furnace; if the latter is made to play the part of the cathode, it is liable to be rapidly attacked and the aluminium produced becomes comparatively impure. C. H. B.

Absorption. IV. Colloidal Ferric Oxide. By JACOBUS M. VAN BEMMELEN (*Zeit. anorg. Chem.*, 1899, **20**, 185—211; see also Abstr., 1897, ii, 137; 1898, ii, 220; this vol., ii, 12 and 84).—The elimination, reabsorption, and the repeated elimination of the water of the hydrogel of ferric oxide, prepared from a dilute ferric solution and ammonia, has been examined in the case of samples; (i) freshly prepared; (ii) air-dried and many years old; (iii) kept under water for a considerable time. The results agree with those obtained for the hydrogels of silicic acid and copper oxide. The hydrogel has the properties of an amorphous, colloidal substance, it forms no definite hydrate, and the percentage of water depends on the molecular state due to the conditions under which it is formed, and the modifications due to drying, time, the action of water, temperature, &c. When products are obtained containing $4H_2O$, or a less number of water molecules corresponding with a chemical hydrate, this is due to chance. The experiments again prove that in an amorphous substance the physical molecular condition, and consequently the composition, alters in a perfectly continuous manner. This alteration is very slow at ordinary temperatures, and is accelerated at higher temperatures. E. C. R.

Iron Silicides with a High Percentage of Silicon. By GUILLAME J. L. DE CHALMOT (*J. Amer. Chem. Soc.*, 1899, **21**, 59—66).—By heating a mixture of river sand with finely ground iron ore and coke in the electric furnace, the author has obtained iron silicides containing from 12 to 46 per cent. of silicon. No flux is required, but an excess of silica must be employed, as it readily volatilises and is carried away by the furnace draught; very little slag is formed, and the silicide is run out in a molten state. Iron silicides containing from 25 to 50 per cent. of silicon consist of a mixture of two definite compounds. The first of these, Fe_3Si_2, with 25 per cent. of silicon, separates in large, well-developed crystals on allowing molten silicides containing from 25 to 28 per cent. of silicon to slowly solidify. The second compound, $FeSi_2$, containing 50 per cent. of silicon, the author obtains as a residue on partially dissolving a silicide with 39 per cent. of silicon in dilute hydrofluoric acid; it forms a grey, crystalline, non-magnetic powder. A compound with more than 50 per cent. of silicon could not be obtained, any excess over this proportion separating in small, black crystals. The silicide, FeSi, previously described, is probably not present in the silicides obtained by the author. Iron silicides are always crystalline and of a white or grey colour, some of them being capable of taking a very high polish. They are very hard and brittle, thus forming valuable abrasives, and are good conductors of electricity. Air and water are without action on them, and they are only slowly attacked by all acids with the exception of hydrofluoric acid. The melting point rises and the specific gravity falls with an increase in the amount of silicon. Compounds with little silicon cast well, but with larger proportions, the castings tend to crack on cooling. T. H. P.

Atomic Weight of Nickel. By THEODORE W. RICHARDS and ALLERTON S. CUSHMAN (*Zeit. anorg. Chem.*, 1899, **20**, 352—376. See also Abstr., 1898, ii, 228).—In continuation of their work on the atomic weight of nickel, the authors have determined the weight of nickel obtained from a weighed quantity of nickel bromide by reducing it in a current of hydrogen. The apparatus employed and the method of conducting the analysis are the same as previously described. A careful examination of the nickel bromide shows that it contains 1/10 per cent. of sodium bromide, which is derived from the porcelain tube employed in its preparation, and the authors have been unable to eliminate this impurity. The sodium bromide was therefore determined in each sample of the reduced nickel by extraction with water and precipitating with silver. Weighing the sodium bromide left by evaporation of the extract to dryness gives inaccurate results, since the authors find that, by the action of water on the reduced nickel, a small quantity of nickel is dissolved as colloidal hydroxide. The complete analysis of nickel bromide gave 26·824 per cent. Ni, 73·062 per cent. Br combined with the nickel, 0·089 per cent. Br in the impurities, and 0·025 per cent. Na = 100·000. The mean of eight experiments gave as the atomic weight Ni = 58·709 [O = 16], the extreme values being 58·696 and 58·719. The mean of these and the authors' previous determinations gave as the atomic weight Ni = 58·706. E. C. R.

Action of Hypophosphorous Acid on Molybdic Acid. By Clarence Ebaugh and Edgar F. Smith (*J. Amer. Chem. Soc.*, 1899, **21**, 384—386).—In studying the reduction of molybdic acid by means of hypophosphorous acid, definite volumes of solutions of ammonium molybdate and of hypophosphorous acid of known strength were mixed, water added to the extent of three times the volume of the mixture, and the liquid boiled for a fixed time. After cooling, the solution was re-oxidised by titration with standard permanganate, the volume required indicating the amount of reduction effected by the hypophosphorous acid. The results show that the molybdic acid suffers reduction to the pentoxide (Mo_2O_5), but that the method cannot be used for the accurate estimation of molybdenum. T. H. P.

Tungsten. By Alfred Stavenhagen (*Ber.*, 1899, **32**, 1513—1516).—The author gives details of the method by which he has prepared elementary tungsten with the object of studying its physical properties; the source of the metal was tungstic acid, aluminium borings being employed as the reducing agent. Fused tungsten which has been allowed to solidify has a sp. gr. 16·6; it is sufficiently hard to cut glass, and remains solid in the oxyhydrogen flame. The metal is indifferent towards acids and aqua regia, but dissolves slowly in fused potassium hydroxide, liberating hydrogen. M. O. F.

Atomic Weight of Tungsten and Preparation of Sodium Pertungstate by means of the Electric Current. By George Edward Thomas (*J. Amer. Chem. Soc.*, 1899, **21**, 373—381).—An attempt was made to determine the atomic weight of tungsten by measuring the loss of water of crystallisation (2 mols.) on heating at 268—295° crystals of sodium tungstate obtained both from scheelite and from wolframite. Owing, however, to the great difference between the molecular weight of water and the atomic weight of tungsten, and also to slight losses due to volatilisation of the material, the method does not give good results.

By electrolysing a 30 per cent. sodium tungstate solution slightly acidified with acetic acid, sodium pertungstate is formed, but the author was unable to isolate it in a pure condition. T. H. P.

Tungsten Pentabromide. By Ed. Defacqz (*Compt. rend.*, 1899, **128**, 1232—1234).—Tungsten pentabromide is obtained in well-defined, fern-like aggregates of dark needles with a green reflex, by passing dry hydrogen bromide over tungsten hexachloride heated at 300°; it is very hygroscopic, yielding the blue oxide on treatment with water and dilute acids; it is soluble in the following organic solvents: carbon tetrachloride, chloroform, bromoform, ether, alcohol, turpentine, and benzene. It is decomposed by oxygen into a mixture of oxybromides and tungstic acid, and when heated with chlorine, sulphur, or phosphorus, yields the chloride, sulphide, or phosphide respectively; the latter compounds are also produced by the action of hydrogen sulphide and hydrogen phosphide; it may be volatilised without decomposition in an atmosphere of carbonic anhydride. Concentrated solutions of hydrofluoric and hydrochloric acids dissolve the pentabromide, the latter reagent giving an indigo blue solution;

fuming hydrobromic acid partly dissolves the substance, concentrated sulphuric acid has no action in the cold. Nitric acid oxidises the bromide to tungstic acid, and the reaction is utilised in analysing the substance. Hydrogen iodide at 400° decomposes the bromide, giving rise to an iodide. The pentabromide is readily attacked by alkalis, whether molten or in solution, and by fused alkali nitrates, carbonates, and bisulphates. G. T. M.

Reaction between Some Salt Solutions and an Alkaline Solution of Antimony Trioxide. By M. C. HARDING (*Zeit. anorg. Chem.*, 1899, **20**, 235—239).—A black precipitate, containing platinum and antimony approximately in the ratio 1Pt : 2Sb, is obtained by adding a dilute solution of hydrogen platinochloride to excess of an alkaline solution of antimony trioxide. When treated with dilute hydrochloric acid, it yields a residue of metallic platinum, and an equal quantity of platinum is dissolved.

An acid or alkaline solution of gold, when added to excess of an alkaline solution of antimony trioxide, gives a precipitate of aurous oxide containing from 6·5—26·0 per cent. of antimony. When a neutral solution of gold is employed, the precipitate contains gold and antimony, approximately in atomic proportion. When excess of gold solution is employed, the precipitate consists almost entirely of aurous oxide.

Mercuric and mercurous salts are converted into metallic mercury and mercurous oxide by excess of the antimony solution. If the mercury salt is in excess, then mercurous oxide is formed.

Cupric antimonite, $CuSb_2O_4$, is obtained by adding a dilute solution of copper sulphate to an excess of the alkaline antimony solution, or by adding copper sulphate to a solution of potassium antimonyltartrate in 8 per cent. aqueous potassium hydroxide; it is a green, crystalline powder, is soluble in hydrochloric, tartaric, or citric acids, and when heated in an open crucible at first evolves antimony oxide and then explodes, leaving a residue of antimony trioxide and copper oxide; when heated in a closed vessel, the residue contains metallic copper.

When treated with excess of the antimony solution, ferric chloride yields a red solution, which, on warming, deposits a brown precipitate containing varying proportions of ferric oxide and antimony trioxide The red solution is very unstable, and is immediately decolorised when shaken with the carbonates of calcium, barium, strontium, magnesium, or lead.

An alkaline solution of antimony trioxide yields, with potassium permanganate, a precipitate containing manganese peroxide and antimony trioxide, reduces chromates with the formation of chromoxy-compounds, and with stannous chloride yields metallic antimony mixed with a small quantity of tin. E. C. R.

Antimony Pentasulphide. By OTTO KLENKER (*J. pr. Chem.*, 1899, ii, **59**, 150—194. Compare Bosek, Trans., 1895, **67**, 515; and Brauner, *ibid.*, 527).—The action of heat, of water, of tartaric acid, and of hydrochloric acid on antimony pentasulphide was investigated; the experiments showed the ease with which the quinquevalent compound is converted into the black, crystalline trisulphide and then into antimonious oxide, the latter change occurring at a temperature of 230°, whilst the former is brought about by heating in an air-bath to 150°. Alcohol, benzene, and chloroform at the boiling temperatures extract as much sulphur from the pentasulphide as carbon bisulphide does, but in the latter case less time is required for the extraction. Boiling oil of turpentine also causes partial decomposition of the pentasulphide. F. H. N.

Perniobic and Pertantalic Acids and their Salts. By Petr G. Melikoff and L. Pissarjewsky (*Zeit. anorg. Chem.*, 1899, **20**, 340—351).—*Perniobic acid*, $HNbO_4 + nH_2O$, is obtained by warming niobic acid with hydrogen peroxide on the water-bath; the conversion is not, however, complete, and the acid is more easily prepared by treating its potassium salt with dilute sulphuric acid and subjecting the mixture to dialysis. The dialysed solution is evaporated on the water-bath when the perniobic acid is obtained as a gelatinous precipitate which dries to a yellow, amorphous powder insoluble in water; it is not decomposed by dilute sulphuric acid at the ordinary temperature, but decomposes on heating, with formation of hydrogen peroxide; concentrated sulphuric acid decomposes it with evolution of ozone and oxygen, and when heated at 100° it gradually decomposes with evolution of oxygen. The *potassium* salt, $K_4Nb_2O_{11} + 3H_2O$, is obtained by fusing niobium pentoxide (1 mol.) with potassium hydroxide (8 mols.) in a silver crucible, the product is extracted with the least possible amount of water and the filtrate warmed with a small quantity of hydrogen peroxide, filtered, and precipitated with alcohol; the amorphous precipitate is washed with alcohol and ether, dissolved in a solution of hydrogen peroxide and potassium hydroxide, and again precipitated with alcohol; it is a white, crystalline powder, soluble in water, evolves oxygen when warmed, and hydrogen peroxide or ozonised oxygen when treated with dilute or concentrated sulphuric acid. Of the 11 atoms of oxygen, 4 atoms are active, so that the salt is a compound of pyroperniobic acid with 2 mols. of potassium peroxide and 2 mols. of potassium oxide. When allowed to remain in aqueous solution, it is slowly decomposed into the salt, $KNbO_4$, together with acid salts of the pyro-acid.

Pertantalic acid, $HTaO_3 + nH_2O$, is obtained as a white, powdery precipitate by treating its potassium salt with dilute sulphuric acid. It has similar properties to perniobic acid, but is more stable and is not decomposed by heating at 100°. The *potassium* salt, $K_3TaO_8 + \frac{1}{2}H_2O$, is obtained by fusing tantalum pentoxide with potassium hydroxide and treating the melt in a similar way to that described for the salt of perniobic acid; it has similar properties to the perniobate, and since it contains four active oxygen atoms is a salt of orthopertantalic acid in which the hydrogen atoms are replaced by the radicle KO. The *barium* salt is obtained as a white, voluminous precipitate when barium chloride is added to the aqueous solution, and is decomposed by carbonic anhydride with formation of hydrogen peroxide.

Potassium calcium pertantalate, $KCaTaO_8 + 4\frac{1}{2}H_2O$, is obtained as a fine, crystalline powder by adding calcium chloride to a solution of the potassium salt; it forms microscopic, rhombic prisms, is insoluble in cold water, and when warmed with water forms a voluminous precipitate, the solution becoming alkaline, and oxygen being evolved. The *sodium* salt, $Na_3TaO_8 + H_2O$, is obtained by warming sodium hexatantalate with hydrogen peroxide and adding sodium hydroxide; the filtered solution is treated with excess of hydrogen peroxide, cooled with ice, and precipitated with alcohol. It is a white, amorphous powder, difficult to dissolve in water.

The *sodium* salt, $NaTaO_4 + NaO \cdot TaO_4 + 13H_2O$, is obtained by evaporating a solution of sodium hexatantalate to dryness on the water-bath; the aqueous extract of the residue is treated with a few drops of hydrogen peroxide and precipitated with alcohol. It is a white, amorphous powder, and yields hydrogen peroxide when treated with dilute sulphuric acid.

The examination of pervanadic, perniobic, and pertantalic acids shows that their salts are less stable as the atomic weight of the metal from which they are produced decreases (Abstr., 1898, ii, 165 and 337). E. C. R.

Preparation of Potassium Platosochloride. By MAURICE VÈZES (*Bull. Soc. Chim.*, 1898, [iii], **19**, 879—883).—The treatment of potassium platinochloride with a quantity of normal potassium oxalate sufficient to effect the reduction of the salt without converting it into platoso-oxalate (see this vol., i, 572) constitutes a simple and economical means of preparing potassium platosochloride. For this purpose, 100 grams of the platinochloride and 37 grams of potassium oxalate are boiled with a litre of water for several hours until all is dissolved; on cooling the solution, potassium platosochloride crystallises out to the extent of about 80 per cent. of the theoretical yield, and a further quantity is precipitated by adding alcohol to the mother liquor. N. L.

Volatilisation of Osmium in a Current of Air or Oxygen. By MAURICE VÈZES (*Zeit. anorg. Chim.*, 1899, **20**, 230—232).—The author points out that Šulc's observations (this vol., ii, 299) on the oxidation and subsequent volatilisation of osmium are not new. The amount of oxidation, and subsequent loss in weight, depends on the physical condition of the osmium, that is, on the fineness of the powder and the method by which it is prepared. E. C. R.

Mineralogical Chemistry.

Sulphur and other Minerals from the Malfidano Mines near Buggerru, Sardinia. By FEDERICO MILLOSEVICH (*Real. Accad. dei Linc.*, 1898, 7, 249—254).—Measurements are given of crystals of sulphur and anglesite obtained from galena. The sulphur crystals are very small, being never more than 1·5 mm. in longest diameter; they are, however, very rich in brilliant faces, in one case 27 different forms occurring on a single crystal. Three new forms are observed, namely, (305), (155), and (319), bringing the total number of forms known up to 36. The axial ratios observed were $[a:b:c=0{\cdot}81368:1:1{\cdot}90472]$, whilst von Kokscharoff obtained $[a:b:c=0{\cdot}81309:1:1{\cdot}90339]$. The anglesite crystals, which are colourless and transparent and attain a length of 5 mm., do not exhibit new forms; they give the axial ratios $[a:b:c=0{\cdot}78547:1:1{\cdot}28877]$, von Kokscharoff's numbers being $[a:b:c=0{\cdot}78516:1:1{\cdot}28939]$. T. H. P.

Hungarian Coals, &c. By ALEXANDER VON KALECSINSZKY (*Jahresber. k. ung. geol. Anstalt*, 1897 (for 1894) 162—170; 1898 (for 1896), 198—203. Compare Abstr., 1897, ii, 417).—Technical analyses are given of coals, clays and petroleum. L. J. S.

Analyses of Austrian Minerals, &c. By CONRAD H. VON JOHN and C. FRIEDRICH EICHLEITER (*Jahrb. k. k. geol. Reichsanstalt, Wien*, 1898 (1897), **47**, 737—766. Compare Abstr., 1896, ii, 252).—This is a collection of numerous (203) technical analyses of coals, ores, waters, rocks, salts, petroleum, artificial products, &c., made during 1895—7 in the Chemical Laboratory of the Royal Geological Institute at Vienna.

Graphite from St. Lorenzen, Styria, gave I; from Březinek near Gewitsch, Moravia, II:

	C.	Ash.	Hygroscopic H_2O.	Comb. H_2O.	Total.
I.	66·22	30·55	1·60	1·63	100·00
II.	7·40	84·20	8·35		99·95

Fahlerz from Payerbach gave: Cu, 31·15; Ag, 0·024; Au, 0·001 per cent., also S, Sb, Zn, and Pb.

Decomposed wollastonite from near Üsküb gave:

SiO_2.	Al_2O_3.	FeO.	CaO.	MgO.	Loss on ignition.	Total.
43·36	7·82	5·04	39·70	2·56	2·06	100·54

L. J. S.

Goldschmidtite, a New Mineral. By WILLIAM H. HOBBS (*Amer. J. Sci.*, 1899, [iv], **7**, 357—364).—The new mineral was found as small, bright, prismatic crystals on chalcedony in a granite-breccia cemented by phonolite from the Gold Dollar mine in Arequa Gulch, Cripple Creek district, Colorado. The symmetry is monoclinic, and possibly clinohedral, with $[a:b:c=1{\cdot}8562:1:1{\cdot}2981;\ \beta=89^\circ\,11']$; a list of 22 forms is given. The colour is silver-white with bright metallic lustre; streak dull greyish-black. Brittle; H = 2. There is a perfect cleavage parallel to $b(010)$, and the crystals are frequently twinned on $a(100)$. Analysis made on about 0·1 gram of nearly pure material gave the formula Au_2AgTe_6.

Au.	Ag.	Te.	Total.
31·41	8·95	[59·64]	100·00

This composition is intermediate between that of sylvanite, $AuAgTe_4$, and of calaverite, $(Au,Ag)Te_2$, and it is suggested that the three minerals form a homologous series, as in the humite-group; in passing from calaverite to sylvanite, there is a gain of Ag_2Te and a loss of $Au_{\frac{5}{3}}$.

Calaverite............	$Au_{\frac{27}{3}}Ag_{\frac{5}{3}}Te_{21}$
Goldschmidtite......	$Au_{\frac{22}{3}}Ag_{\frac{11}{3}}Te_{22}$
Sylvanite	$Au_{\frac{17}{3}}Ag_{\frac{17}{3}}Te_{23}$

Between goldschmidtite and sylvanite there is a somewhat close crystallographic relationship; for sylvanite [$a : b : c = 1{\cdot}6339 : 1 : 1{\cdot}1265$; $\beta = 89° 35'$], and the cleavage is also $b(010)$. L. J. S.

Minerals Associated with Diamonds from Bahia. By EUGEN HUSSAK (*Tsch. Min. Mitth.*, 1899, **18**, 342—359).—A description is given of 39 minerals occurring in the diamond sands of Bahia, Brazil.

Diaspore in cleavage flakes, closely resembling the accompanying kyanite in appearance, gave, on analysis, Al_2O_3, 85·48, loss on ignition, 15·01 = 100·49.

Ilmenite (hydroilmenite) occurs as rounded grains, often with a nut-brown crust of an earthy decomposition product. The latter also occurs as rolled grains with bright cleavages following the parting planes of the original ilmenite, and in places enclosing specks of ilmenite and minute needles of rutile; analysis gave TiO_2, 65·50; loss on ignition, 4·94, the remainder being only iron. The alteration of ilmenite therefore consists of the separation of the iron as ferric oxide, and the titanic oxide as rutile or anatase. L. J. S.

Occurrence, Origin and Composition of Chromite. By JULIUS H. PRATT (*Amer. J. Sci.*, 1899, [iv], **7**, 281—286).—Chromite occurs in the peridotites of North Carolina as scattered grains or crystals, but near the margins of the intrusive masses it is more abundant and fills large pockets. Like the corundum (Abstr., 1898, ii, 603) in the same rocks, the chromite has been one of the first minerals to crystallise out from the magma. The magma may be regarded as a solution from which the more basic minerals (chromite, spinel and corundum) are the first to crystallise, not according to their fusibility, but according to their solubility in the fused mass. There would, therefore, be a concentration of these minerals at the cooling margins of the intrusive mass.

The following analyses by C. Baskerville and H. W. Foote, are given of pure selected chromite from: I, Price's Creek in Yancey Co.; II, Corundum Hill in Macon Co.; III, Webster in Jackson Co.

	Cr_2O_3.	Al_2O_3.	FeO.	MgO.	SiO_2.	MnO.	Formula.
I.	59·20	7·15	25·02	4·42	3·20	0·92	10 Ch. + 2 Sp. + MgO,Cr_2O_3.
II.	57·80	7·82	25·68	5·22	2·80	0·69	9 Ch. + 2 Sp. + MgO,Cr_2O_3.
III.	39·95	29·28	13·90	17·31	—	—	Ch. + 2 Sp. + MgO,Cr_2O_3.

Ferric oxide was shown to be present, but the amount could not be determined, so that the bivalent oxides in the analyses are slightly in excess of the tervalent. In the formulæ given above, Ch.(chromite) = FeO,Cr_2O_3, and Sp.(spinel) = MgO,Al_2O_3; the third isomorphous molecule, MgO,Cr_2O_3, is not known as a natural mineral. Analyses I and II represent the composition of the majority of chromites; only two terrestrial occurrences being known which are pure FeO,Cr_2O_3. An increase in the amount of alumina and magnesia gives a passage to picotite (chrome-spinel); for intermediate members having a composition similar to that shown by analysis III, the new name *mitchellite* is proposed. This mineral from Webster differs from ordinary chromite in being much coarser grained; it appears to be identical with Bock's magnochromite from Silesia (Abstr., 1874, 666). L. J. S.

Barytocelestines. By C. W. Volney (*J. Amer. Chem. Soc.*, 1899, **21**, 386—388).—A new barytocelestine from the Silurian limestones of Eastern Ontario is described. It has the composition $BaSO_4,3SrSO_4$, and contains traces of ferric oxide and alumina. Its specific gravity is 4·123. T. H. P.

New Cobaltiferous and Nickeliferous Minerals from Messina. By Giuseppe La Valle (*Real. Accad. dei Linc.*, 1898, **7**, 68—71).—In the dolomitic limestone from the territory of Mandanici near the Peloritani mountain range, there are conglomerates of limonite, malachite, and azurite mixed with a yellow, ochreous, earthy substance, which are more or less friable. On breaking these masses, the surfaces of fracture are in some cases covered with a crimson layer, which, under the microscope, is seen to have a fibrous structure, and to consist of small crystals with a pearly or vitreous lustre. These crystals are apparently monoclinic, the angle (100) : (001) being about 54°; they colour a borax bead sapphire blue, and from this, they are considered to be crystals of erythrite. Scattered here and there in the earthy mass mentioned above, flaky globules are also found of a beautiful, apple-green colour and a light indigo-blue coating. On chemical examination, the globules prove to be annabergite, possibly derived from the decomposition of cobaltiferous and nickeliferous pyrites. The blue substance, which contains arsenic and iron, the author regards as symplesite, $Fe_3As_2O_8 + Aq$. Along with the above-described minerals, there occurs also a brown substance in the form of minute granules or amorphous globules; this contains cobalt and manganese, and is probably asbolan.

Such associations of minerals have also been found in other parts of Sicily. T. H. P.

Powellite Crystals from Michigan. By Charles Palache (*Amer. J. Sci.*, 1899, [iv], **7**, 367—369).—Powellite was first discovered in Idaho (Abstr., 1891, 886) and afterwards at the South Hecla Copper Mine, Houghton Co., Michigan (Abstr., 1894, ii, 240). A crystallographic description is given of two fine crystals from the latter locality; these show the symmetry of scheelite (tetragonal, pyramidal-hemihedral), with angles closely agreeing with Melville's determinations for the original powellite. The colour is pale bluish-green, and the sp. gr. 4·355. A third specimen, consisting of a rounded mass of powellite, has the same bluish-green colour in the central part, shading off in the surface layer to black and opaque, or in thin splinters deep Prussian-blue. The dark coloured portion has the lower sp. gr. of 4·214; it is therefore probably almost pure calcium molybdate (calculated sp. gr. 4·267) with very little calcium tungstate.

L. J. S.

Solubility of Natural Silicates in Water. By GEORGE STEIGER (*J. Amer. Chem. Soc.*, 1899, 21, 437—439).—In extension of Clarke's qualitative experiments on the alkaline reaction of natural silicates, the amount of alkali dissolved by a given volume of cold water acting for a definite time on a number of natural silicates has been determined. T. H. P.

Roscoelite. By WILLIAM F. HILLEBRAND, HENRY W. TURNER and FRANK W. CLARKE (*Amer. J. Sci.*, 1899, [iv], 7, 451—458).—The analyses of Roscoe and Genth of this rare vanadium mica are not in agreement; a new analysis has therefore been made with carefully purified material from the Stockslager mine on Granite Creek in Eldorado Co., California. By heating the mineral with dilute sulphuric acid in an atmosphere of carbonic anhydride in sealed tubes, and titrating, it was found that 93·5 per cent. of the vanadium existed as V_2O_3. Allowing for slight oxidation, it is therefore assumed, with Genth, that the whole of the vanadium exists as V_2O_3 rather than as V_2O_5, as given by Roscoe. The results of the new analysis are:

SiO_2.	TiO_2.	V_2O_3.	Al_2O_3.	FeO.	MgO.	K_2O.	Na_2O.
45·17	0·78	24·01	11·54	1·60	1·64	10·37	0·06

Li_2O.	H_2O 105°.	H_2O 280°.	$H_2O > 280°$.	Total.
trace	0·40	0·17	4·12	99·86

Neglecting titanic oxide and water lost below 280°, the above composition may be approximately expressed by Clarke's mica theory (Abstr., 1897, ii, 52) as $Al(SiO_4)_3FeKMg_2H_2 + Al(Si_3O_8)_3AlK_2H_4 + 8Al(SiO_4)_3V_2KH_2$. The first of these molecules represents the normal phlogopite type, the second is a trisilicate alkaline biotite, and the third a muscovite with two-thirds of the aluminium replaced by vanadium. Roscoelite may therefore be considered to be essentially a vanadium muscovite.

Roscoelite has been found in association with gold at four localities in Eldorado Co., California. It occurs at the junction of intrusive granodiorite with the surrounding sediments and lavas. The mineral is optically negative and biaxial, with a very small angle, being almost uniaxial; it is pleochroic. L. J. S.

Hydromica from New Jersey. By FRANK W. CLARKE and NELSON H. DARTON (*Amer J. Sci.*, 1899, [iv], 7, 365—366).—The walls of calcite veins in a decomposed diabase at Rocky Hill, New Jersey, are lined with a thin coating of a bronze-yellow hydromica, which in places also extends down the cleavage planes into the masses of calcite. The mineral is soft and is composed of minute flakes thinly matted together. It is optically biaxial with a very small angle, and is pleochroic. Before the blowpipe, it fuses without exfoliation to a dark-coloured bead; it is readily decomposed by hydrochloric acid. Analysis by G. Steiger gave, after deducting 18·5 per cent. of calcite and a little titanic oxide,

SiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	MgO.	K_2O,Na_2O.	H_2O 100°.	$H_2O > 100°$.	Total.
40·24	10·34	24·57	5·21	6·78	2·20	3·03	7·63	100·00

This gives, according to Clarke's mica theory (Abstr., 1897, ii, 52), the formula, $3Al(SiO_4)_3Al_2KH_2 + 6R'''(SiO_4)_3H_3R'''_2 + 5R'''(SiO_4)_3R''_3H_2$

$+ 3H_2O$, where $R''' = Al : Fe''' :: 2 : 3$ and $R'' = Fe'' : Mg :: 3 : 7$. The muscovitic and phlogopitic molecules are in the ratio of 9 : 5. Since the potassium is largely replaced by water, and there is water of crystallisation, the substance is a mica altered to vermiculite. The large amount of ferric oxide is unusual (compare baddeckite, this vol., ii, 110), and suggests that the original mineral was a ferric muscovite, a mineral which is theoretically possible, although not known. L. J. S.

Chloritoid from Hungary. By Julius Szádeczky (*Sitz.-Ber. Siebenbürg. Museumvereins*, 1897 (1896), **19**, *Revue*, 1—8).—The phyllites of the Zsil Valley near Surduk, in the Southern Carpathians (Comitat Hunyad) contain crystals of chloritoid, which on analysis by Béla Ruzitska gave the following results. The material analysed was much intergrown with quartz and hæmatite:

SiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	MgO.	H_2O.	Total.
33·20	37·91	7·50	18·79	1·03	1·90	100·33

The material is only slightly soluble in concentrated hydrochloric acid, but is completely decomposed with separation of silica by long boiling in concentrated sulphuric acid. L. J. S.

Scottish Silicates. By M. Forster Heddle (*Trans. Roy. Soc. Edin.*, 1899, **39**, 341—359).—Nineteen analyses are given of silicates to which the old name schorl was formerly indiscriminately applied.

I. Tourmaline, as jet-black crystals from a granite vein near Struay Inn, Ross-shire; contains also F 1·71, P_2O_5 trace, and by difference, B_2O_3 10·77 per cent.

II. Fibrolite, as fibres surrounding, and in parallel growth with, red andalusite from Clashnaree Hill, near Auchendoir, Aberdeenshire.

III. Kyanite from North Glen Esk, Forfarshire. IV. Kyanite as blue crystals in margarodite-slate from Glen Urquhart, Inverness-shire.

V. Epidote as olive-green crystals embedded in hornblende from Nudista, Hillswick, Shetlands. VI. Epidote, pale-green crystals embedded in prehnite from Delnabo, Glen Gairn, Aberdeenshire.

VII. Zoisite in quartz from Milltown, Glen Urquhart. VIII. Zoisite as large, grey crystals from the same locality. IX. Zoisite as grey crystals from Loch Garve, Ross-shire.

	SiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	MnO.	CaO.	MgO.	K_2O.	Na_2O.	H_2O.	Total.	Sp.gr.
I.	35·54	35·55	0·18	7·12	0·31	1·11	3·54	1·07	0·43	2·95	—	—
II.	38·41	61·43	0·21	—	0·11	—	—	—	—	0·23	100·39	—
III.	36·38	58·30	1·61	1·12	—	0·86	—	0·25	0·42	1·45	100·39	3·538
IV.	37·53	58·10	2·09	--	—	0·13	0·08	0·25	0·74	1·20	100·12	3·016
V.	37·87	24·72	9·96	0·36	0·54	23·10	0·77	—	—	2·82	100·14	3·396
VI.	38·37	26·09	10·39	—	0·74	21·65	0·24	—	—	2·44	99·92	—
VII.	41·56	29·90	—	3·21	—	22·14	0·33	0·35	0·68	2·19	100·36	3·014
VIII.	39·51	30·83	—	2·52	0·08	22·81	—	0·68	0·9	2·51	99·83	3·32
IX.	40·07	30·83	1·58	0·48	0·22	23·66	0·48	0·50	0·43	2·10	100·35	3·268

Other (previously published) analyses are given of andalusite, fibrolite, kyanite, epidote, withamite, zoisite, and idocrase.

L. J. S.

Anatase and Brookite from near Dublin. By Joseph P. O'Reilly (*Sci. Proc. Roy. Dublin Soc.*, 1898, N.S., **8**, 732—740).—The heavy residue obtained from a yellowish clay filling joints in the quartzite at Shankill, near Dublin, was found to contain crystals of quartz and brookite together with tetragonal pyramids resembling anatase in appearance. The last has a sp. gr. 3·578, which is lower than that of pure anatase (3·9); analyses by W. L. Warren of the [homogeneous?] crystals gave I and II; these approximate to Eakin's analysis of "xanthitane," an earthy decomposition of sphene, from North Carolina. It is assumed that the alumina is an essential constituent replacing titanic oxide. The yellowish clay in which the crystals are found gave the results under III.

	SiO_2.	Al_2O_3.	FeO.	Fe_2O_3.	CaO.	MgO.	MnO.	TiO_2.	Alkalis.	H_2O.	Total.
I.	3·30	12·86	15·20	1·05	2·29	4·42	trace	60·72	0·06	0·06	99·96
II.	3·07	13·02	10·40	6·01	2·16	4·42	trace	60·81	0·12	—	100·01
III.	44·40	35·45	—	6·75	0·65	0·99	—	6·22	0·10	5·46	100·02

The brookite occurs as small, light-brown plates of sp. gr. 3·928.

L. J. S.

Ores and Rocks from British Columbia. By J. C. Gwillim and W. S. Johnson (*Canadian Record Sci.*, 1897, **7**, 293—302).—A description is given of the Southern Slocan Mining Division in West Kootenay, British Columbia. The country rock is a grey granite with quartz, felspar, biotite and hornblende, and a good deal of accessory sphene. Large crystals of impure orthoclase, enclosing scales of biotite, gave on analysis the results under I. The granite itself gave II.

	SiO_2.	Al_2O_3.	Fe_2O_3.	CaO.	MgO.	K_2O.	Na_2O.	Total.
I.	59·86	20·26		2·90	0·78	12·39	5·76	101·95
II.	60·09	17·20	6·73	8·24	0·47	6·23	2·45	101·41

Other rock analyses are given in the paper. L. J. S.

Rock-forming Biotites and Amphiboles. By Henry W. Turner, with analyses by William F. Hillebrand, Henry N. Stokes and William Valentine (*Amer. J. Sci.*, 1899, [iv], **7**, 294—298).—The following analyses are given of material separated by means of heavy solutions out of rocks from the Sierra Nevada. The powders analysed were examined microscopically, and the small amounts of impurities noted in each case.

I. Black biotite from biotite-granite, at the base of El Capitan, in Yosemite Valley; the phosphoric acid is due to the presence of apatite. The biotite-granite gave analysis II; it contains quartz > plagioclase > orthoclase > biotite, with accessory magnetite, sphene, apatite and zircon.

III. Black biotite in quartz-monzonite, from Blood's Station, Alpine Co. Hillebrand found in the biotite 0·066 and in the rock 0·012 per cent. V_2O_3.

IV. Reddish-brown biotite from pyroxenic gneiss, from the North Mokelumne River in the Big Trees quadrangle. Hillebrand found in the biotite 0·127 and in the gneiss 0·08 per cent. V_2O_3.

V. Biotite, sp. gr. 3·05, from a block of quartz-monzonite by the Tioga road, south-east of Mt. Hoffmann, in the Mt. Dana quadrangle.

VI. Amphibole, with strong pleochroism (brown to greenish-brown) and large extinction angle, from amphibole-gabbro, from Beaver Creek, in the Big Trees quadrangle. The amphibole-gabbro (anal. VII, also FeS_2, 0·20) is composed chiefly of labradorite and hornblende, with a little pyrites and pyrrhotite.

VIII. Amphibole, sp. gr. 3·203, with large extinction angle and pleochroism in dark green tints, from the same block of quartz-monzonite as No. V. Analysis IX gives the composition of an average quartz-monzonite of the region.

	I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.
SiO_2	35·64	71·08	35·62	36·62	35·75	46·08	47·27	47·49	66·83
TiO_2	1·12	0·22	2·61	3·03	3·16	0·77	0·92	1·21	0·54
ZrO_2	—	0·08	—	—	Nil	—	—	Nil	0·04
Al_2O_3	18·62	15·90	15·24	14·37	14·70	10·56	20·82	7·07	15·24
Cr_2O_3	—	—	—	—	trace	—	trace	—	—
V_2O_3.........	—	—	—	—	0·05	—	0·02	0·04	—
Fe_2O_3	5·54	0·62	4·69	4·04	4·65	2·81	1·85	4·88	2·73
FeO	14·60	1·31	13·67	17·09	14·08	8·30	4·26	10·69	1·66
MnO	0·79	0·15	0·74	0·40	0·45	0·15	trace	0·51	0·10
NiO,CoO....	—	—	—	—	0·02	—	Nil	0·02	—
CaO..........	0·90	2·60	0·95	1·48	0·17	12·64	13·02	11·92	3·59
SrO	Nil	0·02	trace	trace	?	Nil	trace	Nil	0·03
BaO	trace	0·04	0·26	0·33	0·12	Nil	Nil	Nil	0·11
MgO.........	9·72	0·54	12·70	9·68	12·37	14·40	6·44	13·06	1·63
K_2O	9·22	4·08	7·72	8·20	9·19	0·34	0·22	0·49	4·46
Na_2O	0·38	3·54	0·50	0·45	0·32	1·62	2·75	0·75	3·10
Li_2O.........	trace	trace	trace	trace		Nil	Nil	trace	trace
H_2O, 110°..	0·48	Nil	0·94	0·90	1·03	0·17	0·08	—	Nil
H_2O>110°.	2·54	0·30	4·36	3·26	3·64	1·97	1·27	1·86	0·56
P_2O_5.........	0·20	0·10	Nil	Nil	0·03	0·18	0·74	Nil	0·18
SO_3	—	Nil	—	—	—	—	—	—	Nil
Cl............	—	0·02	—	—	—	—	trace	—	0·02
F............	0·26	—	Nil	0·10	0·17	Nil	—	0·06	—
Total...	100·01	100·60	100·00	99·95	99·90	99·99	99·86	100·05	100·82

II and IX also contained traces of CO_2; in V the water was estimated at 105°.

L. J. S.

Origin of Palæotrochis [Analysis of Rhyolite]. By JOSEPH S. DILLER (*Amer. J. Sci.*, 1899, [iv], 7, 337—342).—The name palæotrochis was given by E. Emmons in 1856 to regularly striated bi-conical objects which he regarded as siliceous corals, and the oldest representatives of animal life upon the globe; they occur, together with various shaped concretions, in the so-called Taconic rocks of Montgomery Co., North Carolina. These rocks were formerly considered to be sedimentary quartzites, but it has since been proved that they are volcanic rhyolites. Various authors have previously considered that palæotrochis is merely concretionary, and it is now shown by detailed microscopical examination that these forms are connected with the numerous spherulitic growths in the rhyolite. Similar objects are described from Mexico and Japan.

Analysis by W. F. Hillebrand of the palæotrochis-bearing rock gave :

SiO_2.	TiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	CaO,SrO.	BaO.
79·57	0·11	11·41	0·20	0·70	0·21	0·05

K_2O.	Na_2O.	H_2O.	Total.
3·52	3·46	0·79	100·02

The alumina includes a little phosphoric acid, and there is a trace of magnesia present. L. J. S.

Rocks and Graphite from Ceylon. By Max Diersche (*Jahrb. k.k. geol. Reichsanstalt, Wien*, 1898, **48**, 230—288).—A petrographical description is given of a collection of rocks from Ceylon. Graphite and its mode of occurrence at Ragedara are also described. Enclosed in the graphite are quartz, pyrites, apatite, mica, calcite, green orthoclase, and rock fragments. The green orthoclase, sp. gr. 2·621, gave the following results on analysis ; the green colour is seen in microscope sections to be due to a chloritic substance :

SiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	CaO.	MgO.	K_2O.	Na_2O.	Total.
61·88	18·16	0·85	1·64	0·43	0·08	13·82	2·02	99·44

L. J. S.

[Rock Analyses.] By Friedrich Becke (*Tsch. Min. Mitth.*, 1898, **18**, 94).—Analysis I, by Mrha, of leucite-basanite from the 1891—1893 lava-flow at Atrio del Cavallo, Vesuvius ; II, by H. Kreczmař, of tonalite-gneiss, from Wistra, Carinthia.

	SiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	CaO.	MgO.	K_2O.	Na_2O.	P_2O_5.	Loss on ignition.	Total.
I.	48·99	19·82	2·59	5·26	8·13	2·82	9·06	3·17	0·33	—	100·17
II.	63·09	18·89	3·48	2·02	6·18	1·97	1·30	3·14	—	0·63	100·70

L. J. S.

[Classification of the Volcanic Rocks of Mont-Dore]. By Michel Lévy (*Compt. rend.*, 1899, **128**, 1078—1082).—The volcanic rocks of Mont-Dore are divisible into two series, a central and a peripheral one. The rocks composing these series originate from two different foci of volcanic activity, and analysis shows that there is a corresponding difference in their petrographical and chemical characters. Rock specimens from the central series have already been analysed ; those from the peripheral group have only recently been studied by Bonjean (see following abstract). The magma of the peripheral rocks is very rich in alkalis, potash and soda being present in nearly equal proportions; they contain but little lime. The rocks of the central series consist of basic andesite, labradorite, basalt, and trachyte ; these contain more soda than potash, and more lime is present than in the peripheral series. The rocks of both series contain notable quantities of magnesia and ferric oxide. G. T. M.

Analyses of Volcanic Rocks from the Peripheral Series of Mont-Dore. By Edmond Bonjean (*Compt. rend.*, 1899, **128**, 1096—1097).—Eleven analyses of volcanic rocks from the peripheral series of Mont-Dore ; the specimens analysed belong to the following petrographical species: phonolites, trachytes, tephrite with haüyne, and compact and ophitic basalts (see preceding abstract). G. T. M.

Association of Argillaceous Rocks with Quartz Veins in Brazil. By Orville A. Derby (*Amer. J. Sci.*, 1899, [iv], 7, 343—356).—In the diamond mining region of Diamantina, Minas Geraes, argillaceous selvages are frequently associated with the quartz veins of the metamorphic series. The most frequent is a reddish, foliated clay, which has resulted from the decomposition of a micaceous schist. The inner portions of the veins contain nests of white kaolin mixed with quartz; this has probably been derived from a pegmatite injected in the micaceous schist. A pure sample of the granular kaolin, on analysis by E. Hussak, gave SiO_2, 44·96; Al_2O_3, 42·09; H_2O, 13·25 per cent. A detailed account is given of these clays and the rocks of the district, and in discussing the relations between them the indications of the heavy residues (containing rutile, anatase, xenotime, monazite, &c.) are made use of. An analysis by Hillebrand is given of kyanitic schist. L. J. S.

Tachylyte from the Floor of the North Atlantic. By Pierre Termier (*Compt. rend.*, 1899, **128**, 1256—1258. Compare this vol., ii, 436).—The fragments of tachylyte or hyalobasalt, dredged in the North Atlantic at a point 500 miles to the north of the Azores, contain small, idiomorphic crystals of translucent olivine, together with a series of polychroic, doubly refractive dark brown stains intermingled with a network of fine trichites, all embedded in a vitreous matrix. The stains and trichites appear to indicate an incipient crystallisation of some mineral species, the optical characters of the stains corresponding with those of a ferruginous hornblende. The appearance of this mineral, however, to the exclusion of augite, would be somewhat remarkable, and, moreover, the refractive index of the stains differs only slightly from that of the matrix. G. T. M.

Alleged Existence of Fluorine in certain Mineral Waters. By F. Parmentier (*Compt. rend.*, 1899, **128**, 1100—1101).—Specimens of glass subjected for some time to the action of the waters of Mont-Dore and Saint-Honoré-les-Bains become covered with opaque stains resembling those produced by hydrofluoric acid; these stains are due, however, to the deposition of silica and calcium carbonate. They may be removed by scraping the glass with a sharp knife, and the original lustre of the glass is restored on dipping it in dilute hydrofluoric acid. Moreover, numerous analyses have failed to reveal the presence of fluorine in these mineral waters. G. T. M.

Mineral Waters from East Bohemia. By Conrad H. von John (*Jahrb. k.k. geol. Reichsanstalt, Wien*, 1898, **48**, 375—388).—Detailed analyses are given of seven waters from East Bohemia. The composition is not that of normal spring water; the predominating sulphates probably owe their origin to the decomposition of pyrites in the rocks from which the waters issue. L. J. S.

Chemical Investigations in the Red Sea. By Konrad Natterer (*Monatsh*, 1899, **20**, 1—263).—A detailed account is given of the chemical researches made during a voyage on board the *Pola*, extending from October, 1895, to May, 1896. A large number of analyses were made of the water and of the sea-bottom of the northern half of the Red Sea, and of the Gulfs of Suez and Akaba. Investigations were also made as to the character of the surrounding coasts and of the islands of these waters. Relations are traced between the results obtained and the configuration and movements of the water.

The paper is accompanied by numerous tables of analytical numbers and by maps showing the positions of the stations where observations were made, the depth of water, &c. T. H. P.

Physiological Chemistry.

A Relation between Intra-organic Oxidations and the Production of Kinetic Energy in the Organism. By Alexandre Poehl (*Compt. rend.*, 1899, **128**, 1046—1047).—The author has previously shown that certain mineral waters have a very high osmotic pressure, and their ingestion causes a notable increase in the osmotic pressure of the urine as measured by the reduction in its freezing point. He now finds that the administration of spermine hydrochloride in sodium chloride solution likewise causes an increase in the osmotic pressure of the urine, accompanied by a remarkable increase in the proportion of chlorides and by a high coefficient of intraorganic oxidation. The breaking-down of proteids into substances of lower molecular weight necessarily increases the osmotic pressure of the liquids containing them, and the increase in osmotic pressure produced by spermine confirms the author's view that the physiological effect of this substance is due to a power of accelerating intraorganic oxidation. C. H. B.

Reducing Power of Tissues: the Blood. By Henri Hélier (*Compt. rend.*, 1899, **128**, 1043—1046. Compare this vol., ii, 374).—The blood has very considerable reducing power, and with the exception of the lymph exceeds in this respect every other tissue of the animal body. As a rule, the venous blood has more reducing power than arterial blood, but this is not always the case, and the difference seems to be due, in part at least, to the variable distribution of the blood corpuscles. After food, the number of corpuscles increases in venous blood, but diminishes in arterial blood. The reducing power of the blood increases rapidly as the blood becomes charged with the products of digestion, and then diminishes slowly as nourishment is provided to the other tissues.

The reducing power of the blood varies under the influence of many other causes, such as variable distribution of the corpuscles, variations in the quantity of plasma, and variations due to elimination of the reducing substances resulting from want of assimilation. C. H. B.

Similarity of the Absorption of Liquids in Muscles and in Soaps. By JACQUES LOEB (*Pflüger's Archiv*, 1899, **75**, 303–309).—In a 0·7 per cent. solution of sodium chloride, a muscle takes up only 1 per cent. of water in 18 hours; in an isotonic solution of lithium chloride, its weight remains unchanged. In an isotonic solution of potassium chloride, bromide, or iodide, the muscle takes up 40 per cent. of its weight; in solutions of the chlorides of calcium, strontium, barium, cobalt, or manganese, 20 per cent. This relationship of the absorption of liquids in muscles shows a complete analogy to what occurs in sodium, potassium, or calcium soaps. The main cause in both cases is osmotic pressure, and not capillary force. W. D. H.

Absorption of Iodine by the Skin, and its Localisation in Certain Organs. By F. GALLARD (*Compt. rend.*, 1899, **128**, 1117—1120).—As the result of experiments made on rabbits, the author draws the following conclusions. 1. The healthy skin is penetrated by aqueous solutions of iodides, and the iodine thus introduced into the system can be recognised and estimated in the urine and viscera. 2. The diet plays an important part in the elimination of the iodine. 3. Certain organs, the brain, for example, absorb relatively large proportions of the element. Only a portion of the animal's abdomen was bathed in the iodide solution, and tables are given showing the relationship between the number of baths and the amount of iodine in the urine. The change from the ordinary vegetable fare to a dry, amylaceous diet produces a marked increase in the amount of iodine eliminated. Those organs, like the brain and glands, which are richest in phosphorus and nuclein compounds have the greatest absorptive power for iodine. G. T. M.

Fats of Carbonic Oxide in the Animal Body. By F. WACHHOLTZ (*Pflüger's Archiv*, 1899, **75**, 338—340. Compare this vol., ii, 372).—Gaglio (*Arch. exp. Path. Pharm.*, **22**, 233) has recently published a paper on this subject, in which the conclusions are in the main different from those of the author. Gaglio's methods are not regarded as trustworthy. W. D. H.

Behaviour of Glucosamine Hydrochloride in the Animal Body. By EDMUND FABIAN (*Zeit. physiol. Chem.*, 1899, **27**, 167—177).—Glucosamine hydrochloride is not a source of glycogen. It is recognisable in the intestine 12 hours after its administration, and is found in the urine after large doses (15—20 grams), but not after small doses (3 grams). After subcutaneous injection in doses of 2—3 grams, most of it is found in the urine. The experiments were made on rabbits. W. D. H.

Inorganic Compounds, and Especially those of Iron, in the Human Fœtus. By LOUIS HUGOUNENQ (*Compt. rend.*, 1899, **128**, 1054—1056).—A full developed normal human fœtus contains about 100 grams of inorganic compounds, but the quantity of ferric oxide present is only about 0·42 gram. During the last three months of fœtal life, the absorption of inorganic compounds in general and of iron compounds in particular by the fœtus is twice as great as during the whole of the preceding six months. This excessive drain of inorganic salts from the mother may account for the malnutrition and other pathologic effects often observed during the later stages of pregnancy, and it would probably be advantageous to give, during this period, a diet unusually rich in iron, phosphorus, and calcium. The administration of compounds of these elements in the form of medicine is, however, of little utility. C. H. B.

Lecithin and other 'Myelin Substances' in Brain and Egg-Yolk. By G. ZUELZER (*Zeit. physiol. Chem.*, 1899, **27**, 254—266).—The method adopted for the separation of myelin substances in the brain is as follows: The brain is first extracted with ether. On partial evaporation of the ether, the protagon is partly precipitated; on the removal of this and addition of acetone, a voluminous precipitate is obtained; this is free from cholesterol, which remains in solution. The precipitate consists of several substances containing phosphorus; one of these, protagon, is insoluble in ether free from cholesterol; the part which is soluble in ether is divisible by addition of excess of alcohol into two parts; the one which remains in solution is lecithin, the other, which is precipitated, consists of two new 'myelin substances' which have still to be fully identified. Egg-yolk gives somewhat similar results. W. D. H.

Formation of Uric Acid. By J. WEISS (*Zeit. physiol. Chem.*, 1899, **27**, 216—218).—Croton oil irritates the intestine and causes an increase of leucocytes there, but it does not produce an increase of uric acid in the urine. Glycocine and uric acid itself also give negative results. Feeding with thymus or pancreas produces increase of uric acid, which is not prevented by a simultaneous dose of quinic acid. W. D. H.

Excretion of Phosphoric Acid after Castration. By FRIEDRICH N. SCHULZ and O. FALK (*Zeit. physiol. Chem.*, 1897, **27**, 250—254).—Curàtulo and Tarulli (*Centr. Physiol.*, 1895, **9**, 149—152) state that, after castration, animals secrete much less phosphoric acid in their urine; they regard this as due to a retention of the phosphates in the body. The present experiments, made on bitches before and after removal of the ovaries, lend no support to this statement; the amount of urinary phosphate is practically unchanged. W. D. H.

Fractional Precipitation of the Products of Peptic Digestion by Zinc Sulphate. By E. ZUNZ (*Zeit. physiol. Chem.*, 1899, **27**, 219—249).—By means of zinc sulphate, the products of gastric digestion can be fractionally precipitated. The characters of each fraction are described, and agree very closely with those previously separated with ammonium sulphate by Pick, but zinc sulphate is stated to be the more convenient reagent. The eight fractions are proto-albumose, hetero-albumose, four varieties of deutero-albumose, and two of peptone. W. D. H.

Toxic Action of Sugars. By JULIUS VON KÓSSA (*Pflüger's Archiv*, 1899, **75**, 310—331).—Large doses of sugar injected subcutaneously, or small doses repeated for a long time, produce pathological changes in the organism. The sugars used in the research were principally cane sugar and dextrose; the animals were birds and mammals; the symptoms observed were cyanosis of the comb (in birds), bronchial catarrh, œdema of lungs, diarrhœa, muscular weakness and sleepiness, incoordination, polydipsia, a gouty state, nephritis, and an increased secretion of total nitrogen, urea, and ammonia in the urine. Special attention is directed to symptoms similar to those seen in diabetes.

W. D. H.

Action of Tolylenediamine on the Red Corpuscles. By Louis Lapicque and A. Vast (*Compt. rend.*, 1899, **128**, 1244—1247).—Metatolylenediamine [$Me:(NH_2)_2 = 1:2:4$], introduced subcutaneously into dogs, brings about destruction of the red corpuscles, but its action is not entirely direct, for very little hæmoglobin is found dissolved in the blood plasma, although iron accumulates in the liver and spleen. The poison in small doses diminishes the resistance of the blood corpuscles to plasmolysis; this is demonstrated experimentally by placing some of the blood in hypoisotonic saline solutions of decreasing concentration; it also produces an alteration in the colouring matter consequent on the formation of methæmaglobin; with large doses this change is so pronounced that the blood becomes chocolate coloured. This alteration and weakening of the red corpuscles leads to their destruction by the hæmatolytic organs, and especially the liver.

G. T. M.

Chemistry of Vegetable Physiology and Agriculture.

Decomposition of Cement by Bacteria. By Albert Stutzer and R. Hartleb (*Zeit. angew. Chem.*, 1899, 402—403).—The loss of calcium by a cement exposed to the prolonged action of ordinary drinking water is due, not only to the solvent action of carbonic acid, but may also depend to some extent on the action of bacteria. The brownish, muddy residue of a cement which had lain in water for a long time was washed with sterilised water and then added to a solution of ammonium sulphate containing 1 gram per litre. In 6 days, nitrite was found to be present, and in 14 days the ammonia had entirely disappeared. Asparagine is also converted into nitrite, but much more slowly, and sodium nitrite is slowly oxidised to nitrate through the agency of the microbes present in the cement.

E. W. W.

Fermentation of Bilberry Must. By R. Otto (*Bied. Centr.*, 1899, **28**, 284—286; from *Landw. Jahrb.*, 1898, 261).—Bilberries from Upper Silesia contained acid corresponding with 0·91 to 1·46 per cent. of tartaric acid, and 3·5 to 7 per cent. of sugar. The must which naturally flows from the crushed berries is less acid, and richer in sugar, than that obtained by artificial pressure. To obtain wine which will keep, a considerable amount of sugar has to be added.

Fermentation with ordinary yeast is only vigorous in presence of nitrogenous matter, such as ammonium chloride, or, better, asparagine

(0·6 gram in 1 litre). Pure yeast produced vigorous fermentation in must to which sugar and water alone were added, but the process was 3½ times as long as when nitrogen compounds were present. The best results were obtained with pure yeast and ammonium chloride (20 to 30 grams per hectolitre). N. H. J. M.

Sterilisation of Potable Waters by Ozone. By LOUIS MARMIER and HENRI ABRAHAM (*Compt. rend.*, 1899, **128**, 1034—1035).—Potable water was treated on a large scale with a current of ozone, conducted from the generator into channels of masonry along which flowed the water to be treated. All the pathogenic organisms are destroyed, and only some germs of *Bacillus subtilis* resist the action of the gas. The reduction in the quantity of dissolved organic matter also makes the water a less favourable nidus for any germs that may subsequently fall into it. C. H. B.

Experiments with Ferric Sulphate for Killing the Denitrifying Organisms of Stable Manure, and for Preventing Erysipelas and Swine Fever. By O. MÜLLER (*Bied. Centr.*, 1899, **28**, 348; from *J. Landw.*, 1898, 207).—The preparation employed contained: ferric sulphate, 66·18, sulphuric anhydride, 6·40, and ferrous sulphate, 5·30 per cent. In the case of pure cultivations of denitrifying organisms, the addition of 1 gram of the powder sufficed to sterilise 10 grams of the slightly alkaline solution, or more of a neutral solution, in 24 hours. It is best to employ a solution for destroying the microbes in fæces; 40 c.c. of a 5 per cent. solution is sufficient for 100 grams of manure.

Experiments with pure cultures of erysipelas and swine fever bacteria showed that they were killed by 0·5 per cent. of the powder.

N. H. J. M.

Barium in Plants and Soil. By RICHARD HORNBERGER (*Landw. Versuchs.-Stat.*, 1899, **51**, 473—478).—The ash of different parts of the trunk-wood of two copper-beeches, 102 and 105 years old, was found to contain from 0·97 to 1·20, and 0·57 to 0·90 per cent. of baryta (compare *Mündener forstl. Hefte.*, 1898, No. 14, 94). The soil was found to contain a small amount of baryta; 400 grams extracted with hot 5 per cent. hydrochloric acid yielded 9 milligrams of barium sulphate.

Barium was detected by Forchammer (*Ann. Phys. Chem.*, 1855, [i], **95**, 60) in the ashes of beech, oak, and birch, &c., and by Boedeker and Eckhard (*Annalen*, 1856, **100**, 294) in beech wood and in the sandstone near Göttingen (compare also Scheele, *Opus. Chem. et Phys. Lips.*, 1788, 1, 258). It also occurs in the Nile mud (Knop, *Landw. Versuchs.-Stat.*, **17**, 65) and in wheat grown in the Nile valley (Dworzak, *ibid.*, 398). N. H. J. M.

Reducing and Invertible Sugar in the Stalks of Maize. By CONSTANTIN I. ISTRATI and G. ŒTTINGER (*Compt. rend.*, 1899, **128**, 1040—1043).—In maize, the weight of the stalk diminishes in the inverse ratio of its increase in volume because the assimilation of solid matter is slower than the loss of water. Before inversion and up to 70 days of growth, the juice is generally lævogyrate, but the lævogyrate power gradually diminishes and changes to dextrogyrate, which increases as vegetation advances. The quantity of invertible sugar present is at least twice as great as that of the reducing sugar, and it increases with the age of the plant. The maximum in the green stalks after 94 days growth is about 1·89 per cent., but the proportion in the dry stalk is about 8·62 per cent. C. H. B.

Reducing and Invertible Sugar of Maize Stalks after Removal of the Ear at the Commencement of Formation. By Constantin I. Istrati and G. Œttinger (*Compt. rend.*, 1899, **128**, 1115—1117).—Tables are given showing the effect of removing the ears of maize on the amount of sugar contained in the stalks. The weight of the stalks, the sp. gr. of the sap, and the dry weight increase when the ears are removed. In 10 cases out of the 15 species of maize studied, the removal of the ear promotes an increase of invertible sugar; in the five remaining cases, which are those of plants containing the largest quantity of sugar in the normal condition, the removal of the ear brings about an actual decrease in the amount of sugar present. G. T. M.

Glycollic Acid in the Sugar-cane. By Edmund C. Shorey (*J. Amer. Chem. Soc.*, 1899, **21**, 45—50).—On adding a few drops of nitric acid to sugar-cane juice clarified by means of a slight excess of basic lead acetate, a white, crystalline precipitate is formed; the author shows that this is a mixture of lead salts of glycollic acid. This acid exists as such in the cane, and can be readily isolated by treating the fresh cane-juice with an excess of freshly precipitated cupric hydroxide; the precipitate formed is thoroughly washed with cold water, decomposed with hydrogen sulphide, and the liquid freed from copper sulphide by filtration. The resulting acid filtrate is evaporated until crystals begin to form, when on cooling a solid mass of glycollic acid crystals separates. The quantity of the acid thus obtained corresponds with 75—80 per cent. of the total acidity of the juice. The occurrence of glycollic acid in cane-juice is held to account for (1) the occasional presence of formic acid in the vapours from multiple-effect evaporators, since glycollic acid decomposes below 100°, yielding formic acid. (2) Part, at least, of the colour of low-grade sugar products, as glycollic acid readily chars. (3) The frothing of boiled molasses on standing, the gas to which this is due being evolved in the decomposition of glycollic acid. T. H. P.

Peptone in Sugar Beet Juices. By A. Rümpler (*Bied Centr.*, 1899, **28**, 358; from *Deut. Zuckerind*, 1898, **302**, and *Oesterr. Zeits. Zuckerind*, 1898, **270**).—Peptones were detected in various intermediate products of the manufacture of sugar. It is supposed that peptones behave like amido-acids, showing both acid and alkaline reaction, and combining both with acids and bases. It is possible that, when juices containing lime are treated with sulphurous acid, peptones and also proteids, which resemble peptones in several respects, are precipitated along with calcium sulphite. N. H. J. M.

Girard's Researches on Caoutchouc Milk. By Léon Lindet (*Bull. Soc. Chim.*,1898, [iii], **19**, 812—815).—This is an account of the results, hitherto unpublished, obtained by the late Aimé Girard. From whatever source obtained, caoutchouc milk presents the appearance of a white, somewhat viscous, milky liquid, which is seen by the microscope to consist of a multitude of globules, having a diameter of 3—5μ, suspended in a clear serum. The sp. gr. of the latter, freed from caoutchouc, varies between 1·037 and 1·040. On adding to the "milk," with constant agitation, an equal volume of 95 per cent. alcohol, the globules run together, and the mass of caoutchouc thus formed can be separated and weighed. The following results were thus obtained from a number of specimens:

Source.	Sp. gr.	Caoutchouc per cent.
Pernambuco (*Haucornia speciosa*) ...	0·990	31·6
African lianas	0·987	33·4
Para (*Siphonia elastica*)	0·986	42·6
Nicaragua (*Castilloa elastica*)	0·980	32·3
Algeria (*Ficus macrophylla*)	1·000	37·5
,, (,, ,,)...........	1·005	37·1
,, (,, *elastica*).................	1·001	17·3
,, (,, *nitida*)	0·971	31·3
,, (,, *lævigata*)	1·005	28·0
New Caledonia (*Kickxia Africana*)...	1·005	27·0

The coagulation of the "milk" is in practice brought about by heating, with or without the addition of alum, common salt, sulphuric acid, lemon juice, vegetable infusions, &c. Good results are also obtained by heating the "milk" at 50° and agitating in a churn.

N. L.

Wines obtained by Heating before Fermentation. By Auguste Rosenstiehl (*Compt. rend.*, 1899, **128**, 1050—1052).—The author has compared on a large scale the properties of wines prepared from must that has previously been heated (Abstr., 1897, ii, 339) with wine prepared in the ordinary way. The preliminary heating increases the yield of juice from a given quantity of grapes, and both the unfermented juice and the wine prepared from it are deeper and richer in colour than wine obtained from the same grapes in the usual way; the wines from the heated must also have more body, and are superior in flavour.

The sterilised musts were fermented with yeasts of various definite kinds, and always gave a higher alcoholic strength than the unheated musts. No differences in flavour were observed with different yeasts, and it would seem that there is no advantage in using yeast exclusively of one species. Cultivated yeasts, however, always gave somewhat better results than crude yeast. The wines from the heated musts were always found to be free from the disease known as "turning," whilst other wines made in the same place were infested with the germs of this disease.

C. H. B.

Effect of the Amount of Water and the Richness of Soil on the Development of the Roots and Above-ground Growth of Oats. By M. Tucker and Conrad von Seelhorst (*Bied. Centr.*, 1899, **28**, 269—273; from *J. Landw.*, 1898, **46**, 52).—The experiments were made in zinc vessels containing 17,130 grams of soil (dry). There were three series; with (1) 12·35, (2) 15·41, and (3) 16·44 per cent. of water, and each series included pots without manure and with different amounts of various manures.

Production of grain and straw increased with the amount of water supplied, whilst the amount of roots diminished. With the least amount of water, the development of the roots was greatest, both absolutely and relatively, but the increased amount of roots was unable to supply the amount of food, and especially water, necessary for the production of a corresponding amount of straw and grain. With more water, a smaller quantity of root was able to furnish a greater amount of nutritive matter and water to the above ground growth.

Deficiency of phosphoric acid induced relatively increased production of roots, but, as in the case of deficiency of water, the increased amount of root was unable to compensate for the poorness of the soil. Abundance of manure increases the amount of both roots and above-ground growth; the increase in straw and grain is, however, greater than that of roots, so that in presence of manure a given amount of roots produces more straw and grain than in its absence.

With increased supply of water, and with manure, the proportion of above-ground growth to roots is considerably increased. Without manure and with 14·35 per cent. of water in the soil, the relation of the amount of root to that of grain and straw was 1 : 5·41. With the same amount of water and with manure (P_2O_5, K_2O, and N) the relation was 1 : 6·43. With 16·44 per cent. of water, the relations were 1 : 9·41 and 1 : 16·16 without and with the same manure respectively. N. H. J. M.

Digestibility of Various New Foods and the Changes produced in them when superheated. By BERNHARD SCHULZE (*Bied. Centr.*, 1899, **28**, 287—288; from *Jahresber. agric. chem. Versuchs.-Stat., Breslau*, 1896).—The following percentage amounts of proteids were digested in gastric and pancreatic juice:

1. Residues of the manufacture of wheat starch	98
2. Fish freed from fat	94—97·1
3. Mixture of potato pulp (80) and molasses (20 per cent.)..	76·2

The digestibility of the residues from the manufacture of alcohol from maize may be considerably diminished by superheating, but residues which are merely darkly coloured do not differ much in digestibility from light-coloured residues. The digestibility coefficients as determined were: light-coloured residues, 70·4; moderately-coloured, 69·7; dark brown, 67·7; superheated and partially burnt, 62·5 and 45·2 per cent. N. H. J. M.

Molasses as Cattle Food. By DICKSON and L. MALPEAUX (*Bied. Centr.*, 1899, **28**, 327—328; from *Ann. Agron.*, 1898, **24**, 353).—Experiments in which sheep, pigs, and bullocks were fed without and with molasses in addition to other foods showed in each case an increase in live weight under the influence of the molasses. With cows, no change was observed as regards amount and composition of the milk, but the weight of the cows increased somewhat more than without molasses. The food was also found to be suitable for horses when given with lucerne hay and wheat straw as a substitute for a portion of the oats. Attention is directed especially to the use of molasses as an addition to inferior hay, which would otherwise not be consumed. The molasses contained: sugar, 46; nitrogenous matter, 11·56; water, 26·8; and ash, 9·45 per cent. N. H. J. M.

Investigations of Soils. By **Bernhard Schulze** (*Bied. Centr.*, 1899, **28**, 286; from *Jahresber. agric. chem. Versuchs-Stat. Breslau*, 1896).—Analyses are given of (1) two Bulgarian soils, and (2) of two soils from Asia Minor. The former are very deep soils, whilst the latter are marl soils which produce two crops yearly, notwithstanding imperfect methods of cultivation. The results given are percentages in dry substance.

		Organic Matter.	N.	K_2O.	CaO.	P_2O_5.
1. Bulgaria......	*a.*	6·28	0·157	0·289	1·37	0·291
	b.	17·23	0·801	1·141	2·62	0·475
2. Asia Minor...	*a.*	—	0·305	0·590	20·53	0·093
	b.	10·43	0·267	0·457	11·41	0·176

N. H. J. M.

Injurious Effect of Sea-water on Soil. By A. J. **Swaving** (*Landw. Versuchs.-Stat.*, 1899, 51, 463—471).—In consequence of the high tide and the strong wind on December 23—24, 1894, the sea dams of Zealand and South Holland partly collapsed and let in the sea. Samples of soil, and of the water of the ditches, were taken at different times for determining the chlorine in order to ascertain to what extent the resulting infertility of the soil was due to the presence of sodium chloride. It was found that, whilst in one case the soil, to a depth of 25 cm., contained as much as 6·220 per thousand of chlorine, in two other cases only 0·533 and 1·340 per thousand were present, and that in the course of a year the amounts were greatly diminished.

The unsatisfactory condition of the crops on the flooded land was due partly to the washing out of the soil, and partly to the mechanical action of the sea and the deposition of mud resulting in the formation of hard crusts which hindered the washing out of the sodium chloride, and sometimes prevented germination of seeds. Storp (Abstr., 1884, 856) showed that solutions of sodium chloride cause soils to lose certain manure-constituents. N. H. J. M.

The Causes and the Importance of the Destruction of Nitrates in Soil. By W. **Krüger** and W. **Schneidewind** (*Ann. Agron.*, 1899, **25**, 249—251; from *Landw. Jahrb.*, 1899, 217—253. Compare this vol., ii, 449).—Whilst straw, owing to pentosans present, is especially favourable in promoting denitrification, other compounds, such as sugar, glycerol, citrates, malates, &c., also facilitate the activity of the microbes. Peat, however, is inert. Other conditions favourable to denitrification are excess of moisture—the loss is considerable in submerged soil—and high temperature. In practice, the loss of nitrogen is probably much less than in small experiments.

In the field, the conditions are more favourable to nitrification than is the case with pot experiments, and the amount of nitrates applied in farmyard manure is far greater than the loss.

P. P. Déhérain (*ibid.*, 251) considers that the question of denitrification is not sufficiently important to justify the amount of labour expended on it in Germany, and refers to Bréal's results (Abstr., 1892, 1259; 1896, ii, 444; and *Ann. Agron.*, **23**, 49, and **24**, 130), and to his own indicating that addition of starch to soil causes loss of nitrates (Abstr., 1898, ii, 630). N. H. J. M.

Specific Manurial Requirements of Crops. By Ferdinand Wohltmann (*Bied. Centr.*, 1899, **28**, 314—315; from *Fühling's Landw. Zeit.*, 1898, **47**, 13).—The following conclusions are drawn from the results of experiments on small plots. The soil was a heavy loam.

Dung produced large and healthy crops with cereals, and especially with rape, and improved the soil physically. Lime acted differently with different crops; it gave better results with wheat than with rye and was injurious to maize, clover, and potatoes. Phosphoric acid, as double superphosphate, injured beans, which ripened too soon and had yellow leaves. Kainite produced, with all crops, lighter coloured leaves, and in the case of sugar beet increased the percentage of sugar; it has, however, a very injurious effect on the soil which has to be remedied by applying lime. Ammonium sulphate generally gives greater yields than sodium nitrate, especially with winter cereals. In rainy seasons, as much as 20 per cent. of sodium nitrate may be lost, and there is never any after-effect such as that observed with ammonium sulphate on clover. N. H. J. M.

Use of Artificial Manures for Forcing-House Crops. By Edward H. Jenkins and W. E. Britton (*Ann. Rep. Agric. Expt. Stat., Connecticut*, 1896, **20**, 205—229).—The soils employed were: (1) turf previously mixed with stable manure, and (2) coal ashes mixed with pure calcium carbonate and moss peat. The manures were well mixed with the soils.

The greatest yield of tomatoes was obtained with the following amounts of manures per 100 square feet (8 inches deep): Sodium nitrate, 4·7; dissolved bone black, 0·94; and potassium chloride, 1·13 lbs. With this manuring, the coal-ash soil gave a greater yield than was produced in a rich compost, with or without further addition of artificial manure.

Radishes also grew well in coal ashes with peat and manures, and developed more quickly than in compost. Similar results were obtained with carnations. With cucumbers, a greater yield was obtained in ashes, with artificial manures, than in compost, and the average weight of the single cucumbers was also greater. Sodium nitrate and cotton seed meal were about equally efficient in coal ashes, but in compost the meal gave better results. N. H. J. M.

Manurial Experiments with Flowers. By John Sebelien (*Bied. Centr.*, 1899, **28**, 315—321; from *Gartnertitende*, 1898).—Experiments in which pelargonias, fuchsias, and heliotropes were variously manured showed that diluted liquid manure and potassium phosphate had no effect, whilst sodium nitrate, and mixed manures containing a good deal of nitrogen, had considerable effect on the development of the flowers and vegetative organs. Subsequent experiments with pelargonias manured with the same amounts of nitrogen, but varying amounts of other constituents, showed that a complex manure gave better results than nitrogen alone. The least amount of nitrogen (4·23 grams) gave the best results; twice that quantity was injurious, whilst 16·92 grams was poisonous.

Exclusive nitrogenous manuring produced plants poor in lime, magnesia, phosphoric and sulphuric acids, and nitrogen, whilst the percentage of potash was high. The average percentage composition of the ash of pelargonias manured with the smallest amount of nitrogen in conjunction with other manure constituents was as follows:

K_2O.	CaO.	MgO.	P_2O_5.	SO_3.	Cl.
18·21	21·05	2·34	10·80	7·87	6·13

The dry substance contained: N, 3·29, and ash, 13·44 per cent.

N. H. J. M.

Experiments with Nitragin. By Andrew P. Aitken (*Trans. Highland and Agric. Soc. Scotland*, 1898, [v], **10**, 299—305).—Experiments with vetches, made by Shirra Gibb at Boon, in which nitragin was applied to the soil, gave a very slight increase of produce as compared with the yield obtained without inoculation. The differences are attributed to "accident." On taking up plants from the different plots (without and with inoculation), it was found that some had many large, whilst others were almost free from, nodules, the nodules also varying in size; these differences, however, occurred in all the plots, whether inoculated or not. In experiments at Linhead, Cockburnspath, with beans and vetches grown together, less grain and more straw were obtained when nitragin was applied than without. Several other experiments were made with clover, but the results were all negative. N. H. J. M.

Ammonium Sulphate and Sodium Nitrate [as Manures]. By E. Kloepfer (*Bied. Centr.*, 1899, **28**, 309—314; from *Unters. üb. d. Wirk. d. schwefels. Ammoniak u. d. Chilisalpeters*, *Essen*, 1898).—Whilst sodium nitrate is liable to loss in drainage, ammonia is absorbed and nitrified, and is available to vegetation for a long time. On the other hand, application of ammonium salts often necessitates application of lime, and warm weather is required for nitrification. Nitrate is objectionable on heavy soil by causing the surface to become caked. Ammonium sulphate is preferable for autumn manuring and for oats. N. H. J. M.

Conservation of the Nitrogen of Farmyard Manure. By Casimir V. Rogovsky (*Ann. Agron.*, 1899, **25**, 244—248; from *Inaug. Diss. Leipzig*).—Artificial farmyard manure was prepared by mixing cow-dung (61·7), liquid manure (26·7), and straw (11·6 parts), and was kept in quantities of 6 kilograms for 56 days, both alone and with different amounts of various substances, such as a mixture of sulphuric and hydrofluosilicic acids (a bye-product of the manufacture of aluminium), chalk, chalk and soil, and soil alone. The loss of nitrogen in the manure alone was 36·6 per cent. The addition of acids much diminished the loss, and to a greater extent than could be accounted for by merely combining with the ammonia; this biological action is attributed to the hydrofluosilicic acid. Chalk was very effective in preserving nitrogen, but its action was irregular, whilst soil alone had only a slight effect.

The examination of the nitrogenous matter by Stutzer's copper hydroxide method gave results indicating that the non-assimilable nitrogen increased by 25·6 in the manure treated with acid and by 41·2 when treated with soil. Subsequent experiments, however, in which mustard was manured with the different manures showed that the nitrogen had not become non-assimilable, and that the amount of produce was much higher where the loss of nitrogen had been least. It is concluded therefore that, not only proteids, but also certain amides, are precipitated by Stutzer's method.

The conclusion also is drawn that only the nitrogen of the liquid manure is available to plants, that of straw and fæces being without effect.

Less water is necessary to produce 1 gram of dry substance when highly nitrogenous manure is present than with less nitrogen.

P. P. Déhérain (*ibid.*, 248) considers that the method employed is unsuitable, as with only 6 kilograms of manure the temperature would not rise sufficiently to produce enough carbonic anhydride to retain the ammonia; and the conditions as regards access of air are quite different in such small amounts as compared with heaps containing several cubic yards. Whilst it is of interest that in the time over which the experiments extended only the nitrogen of the liquid manure was utilised, there can be no doubt that the nitrogenous matter of the fæces, originally insoluble, gradually becomes available as time goes on. N. H. J. M.

Effect of Nitrate on the Development of Barley. By Dm. N. Prianischnikoff and S. M. Kouznezoff (*Ann. Agron.*, 1899, **25**, 254—256; from *Izv. Moscow Selskokhov. Inst.*, **3**, 1897, ii, 53).—Experiments similar to Hellriegel's were made with oats grown in sand and manured with various amounts of sodium nitrate in addition to ash constituents. The results show a regular increase of produce with increased addition of nitrate up to a certain point, after which an excess of nitrate is injurious. The nitrate was most completely utilised when given in the smallest amounts. With very small quantities of nitrate, the results indicate that there was possibly a very slight fixation of free nitrogen, presumably under the influence of algæ.

N. H. J. M.

Perchlorate in Chili Saltpetre. By B. Sjollema (*Bied. Centr.*, 1899, **28**, 286—287; from *Deut. Landw. Presse*, 1897, No. 22, 195. Compare Abstr., 1897, ii, 585).—In reply to Wagner (Abstr., 1898, ii, 252), the author states that he only suggested (having no experimental evidence) that 0·5 per cent. of perchlorate is probably injurious. Experiments in which 150—200 kilos. of nitrate containing 1·4 per cent. of perchlorate was applied per hectare showed that rye was much injured by this amount. It is, however, difficult to estimate exactly the amount of perchlorate in sodium nitrate, owing to its uneven distribution.

Other plants seem to be injured less than rye by perchlorate. It is possible that quantities of perchlorate too small to produce visible injury may diminish the yield of a crop.

De Caluwe's experiments with six kinds of Chili saltpetre indicated that, whilst 6 per cent. of perchlorate was very injurious to rye, even 1 per cent. injured the plants. The effect of the perchlorate was only seen 4—5 months after the application of the manure; the plants had been exposed to very heavy rain in the winter months.

N. H. J. M.

Relative Value of Mineral Phosphates. By Dm. N. Prianischnikoff (*Ann. Agron.*, 1899, **25**, 177—187).—Sand culture experiments, in which cereals were manured with various phosphorites, showed that the phosphoric acid was only available to a slight extent. Under the same conditions, certain other plants, such as peas, lupins, buckwheat, and mustard, were able to utilise the phosphoric acid of the phosphorites (compare Schreiber, *Bied. Centr.*, 1897, **26**, 803). Certain soils have the property of rendering phosphorites available for cereals and other plants; of the soils examined, the so-called "podzols" (which consist of very fine siliceous matter mixed with some organic matter) were the most effective, and forest and peaty soils also had the same property. The black soils of Kherson and Nidjni-Novgorod, &c., are without action on phosphorites, and it is supposed that soils originally "active" would become inactive after some years of cultivation sustained by farmyard manure. Further experiments will, however, be necessary.

In analysing phosphorites to ascertain their manurial value, it will be necessary to take into account the conditions under which they are to be employed. A method suitable for indicating the value when applied to cereals on "inactive" soil would obviously be unsuitable in the case of cereals on active soil, or of other plants on any soil, and *vice versâ*.

N. H. J. M.

Composition of the Insoluble Portion of Basic Slag. By Max Passon (*Bied. Centr.*, 1899, **28**, 350—351; from *Landw. Centr. Posen*, 1898, No. 23, 193).—About 500 residues of basic slag, after extraction by Wagner's citrate method, were carefully mixed and analysed. The following percentage results were obtained:—water, 1·00; phosphoric acid, 9·22; phosphoric acid soluble in citric acid, 4·40; lime, 33·75; fine meal, 72·76. The coarse meal contained 12·46 per cent. of total, and 7·48 per cent. of citrate-soluble, phosphoric acid; the fine meal 7·93 and 3·46 per cent. respectively. This result is supposed to be due to the fine meal being more readily extracted in the Wagner process.

N. H. J. M.

Composition of the Waters of Danish Rivers. By T. Westermann (*Bied. Centr.*, 1899, **28**, 291—293; from *Tidsskr. Landbr. Planteavl*, 1898, **4**, 157—165).—Samples of water from the different rivers were analysed in November, 1889 (the time of the year when the land is irrigated), and again in May and August, 1892. The following results show the average composition in parts per million :

	Nitrogen.					CaO and	
	N_2O_5.	NH_3.	Organic.	Total.	K_2O.	MgO.	P_2O_5.
Susaa.........	0·96	1·21	1·78	3·95	2·65	111·8	(0·2)
Odenseaa ...	0·62	1·22	1·21	3·05	2·98	120·4	(0·26)
Storaa	traces	1·22	0·67	1·96	1·46	37·1	(0·3)
Skernaa......	(0·2)	1·46	0·92	2·45	1·69	25·4	(0·2)
Kongeaa......	(0·35)	0·95	1·01	2·07	1·41	52·0	(0·2)
Gudenaa	(0·17)	1·48	0·64	2·25	1·95	51·8	(0·2)

The numbers in brackets were obtained in 1889; the subsequent samples only contained traces of the constituent.

The nitrates in the November samples are doubtless derived from the manure applied to the fields. It is estimated that the Susaa, with a flow of 200 cubic feet per second, carries away N, 15,400 cwt.; K_2O, 10,300 cwt., and CaO and MgO, 436,000 cwt. yearly.

N. H. J. M.

Lysimeter Experiments. By JOSEPH HANAMANN (*Bied. Centr.*, 1899, **28**, 303—305; from *Zeits. landw. Versuchsw. Oesterr.*, 1898, **1**, 399).—The experiments were conducted in metal vessels with a surface of 1 square metre and 50 cm. deep. There were 6 vessels with the same soil, 1 without, and 5 with vegetation. The following amounts (in grams) of constituents were washed out by drainage from April to October, 1896, when the rainfall was unusually high.

	Bare soil.	Red clover.	Barley.	Sugar-beet.	Maize.	Beans.
N_2O_5	1·7309	0·0749	0·0661	0·0097	0·0097	0·0091
K_2O	0·1457	0·0688	0·1161	0·1256	0·0734	0·1105
Na_2O	0·1540	0·1025	0·1161	0·1780	0·1094	0·1243

Experiments were also made with three other soils without vegetation.

The loss of chlorine was much less in cultivated than in bare soil, but the loss of sulphuric acid was only slightly greater without than with vegetation. Phosphoric acid is retained by soil more tenaciously than any other nutritive constituent.

N. H. J. M.

Analytical Chemistry.

Novelties in Laboratory Utensils. By A. GAWALOWSKI (*Zeit. anal. Chem.*, 1899, **38**, 237—242).—These include a burette jet requiring no pinch clamp, and possessing advantages over those of Leybold and Mohr; an improved form of Erdmann's float containing a roll of aluminium foil with horizontal lines cut through it instead of the usual diamond scratch; a simple burette holder, constructed of two pieces of thin brass plate; a pinch-clamp which can be removed without disconnecting the tubes; and a still for the preparation of sterilised distilled water, on the principle of passing the steam through a coil at a high temperature before condensing it. M. J. S.

A New Filtering Medium. By George William Sargent and John Kirk Faust (*J. Amer. Chem. Soc.*, 1899, **21**, 287—288).—For the separation of manganese dioxide from a nitric acid solution in the analysis of steels, the authors recommend a carbon-filtering tube, plugged with glass-wool covered with a layer of "pewter sand" and a thin layer of asbestos. A similar sand filter may also be used with advantage in separating ammonium phosphomolybdate. T. M. L.

Estimation of Hydrochloric Acid in the Contents of the Stomach. By Hans Leo (*Chem. Centr.*, 1899, **1**, 61—62; from *Zeit. Klin. Med.*, **36**, 76—84).—A controversy with Sjöqvist as to the influence of potassium dihydrogen phosphate when estimating free hydrochloric acid by means of barium carbonate (compare Abstr., 1896, ii, 496). L. de K.

Detection of Small Quantities of Bromine in Chlorides. By Henri Baubigny (*Compt. rend.*, 1899, **128**, 1160—1163).—When relatively large quantities of sodium or other chloride containing small quantities of bromide are treated at the ordinary temperature in the manner previously described (Abstr., 1898, ii, 90 and 137), small quantities of chlorine are liberated with the bromine. The liquid in which the vapours have been absorbed must therefore be treated at 100° in the ordinary manner (*loc. cit.*), when the bromine only is liberated. C. H. B.

Separation and Estimation of Bromine in the Presence of Excess of Chlorides. By Henri Baubigny (*Compt. rend.*, 1899, **128**, 1236—1238).—A solution of the salt to be analysed, mixed with potassium permanganate and sufficient hydrochloric acid to decompose all the bromide present, is distilled in a current of air, and the volatile products received in a solution of caustic alkali. Under these conditions, one drop of hydrochloric acid suffices to liberate all the bromine from several milligrams of bromide. The remainder of the analysis is carried out in accordance with the method already indicated (preceding abstract). G. T. M.

Detection and Colorimetric Estimation of Traces of Iodine in Organic Matters. By Paul Bourcet (*Compt. rend.*, 1899, **128**, 1120—1122).—The substance is thoroughly disintegrated, moistened with caustic potash solution, and dried at 100°; the dried mass is then pulverised and fused with caustic potash in a nickel crucible. The product of fusion is extracted with hot water, and the aqueous extract cooled and treated with 20 per cent. sulphuric acid; when the neutral point is reached, the solution is again rendered alkaline with potash, and then added to an equal volume of 95 per cent. alcohol. The greater part of the potassium sulphate is precipitated, and on concentrating the mother liquor and repeating the treatment with alcohol, the sulphate is finally removed. The mother liquor is concentrated to 2 or 3 c.c. and treated with nitric oxide gas in the presence of carbon bisulphide. The colorimetric estimation is made according to the method suggested by Rabourdin and Nicloux. A table is appended giving the amount of iodine in milligrams per kilo. in a series of edible fish. G. T. M.

Apparatus for obtaining Synchronous Gaseous Currents in the Estimation of Atmospheric Gases. By FÉLIX MARBOUTIN and ADRIEN PÉCOUL (*Bull. Soc. Chim.*, 1898, [iii], **19**, 819—820).—A U-tube containing mercury and provided with a bulb in each limb. is made to oscillate round an axis perpendicular to its plane by means of a suitable motor. The bulbs, which are of equal size, alternately fill and empty themselves, and thus regulate the flow of gas to the aspirators with which they are connected. If a clockwork movement is employed, the two currents are not only synchronous but also isochronous. N. L.

Estimation of Sulphur in Pyrites in the Presence of Iron. By OLE N. HEIDENREICH (*Zeit. anorg. Chem.*, 1899, **20**, 233—234).—The solution of the pyrites prepared in the ordinary way by heating with nitro-hydrochloric acid and evaporating three times with hydrochloric acid, is diluted with hot water to about 250 c.c. and then treated with metallic zinc until all the iron is reduced to the ferrous state. The precipitation of the sulphur is effected in the filtered solution in the ordinary way by means of barium chloride. The results are accurate, since the ferrous salt does not come down with the barium sulphate. This method is much simpler than that proposed by Küster and Thiel (this vol., ii, 247). E. C. R.

Estimation of the Total Sulphur in Coal. By UBALDO ANTONY and ADOLFO LUCCHESI (*Gazzetta*, 1899, **29**, 181—184).—One part of the finely powdered coal is intimately mixed with 4 parts of manganese dioxide, 1 part of potassium permanganate, and 2 parts of sodium carbonate; the whole is then placed in a platinum crucible, covered with a thin layer of the oxidising mixture, and heated gradually until the bottom of the crucible is just reddened. After half an hour's heating, the mass is allowed to cool, and is then poured into 40—50 c.c. of water, which is afterwards acidified with nitric acid and boiled. The liquid is filtered, and the sulphuric acid in the filtrate estimated by precipitation with barium chloride. A blank experiment with the oxidising mixture alone is advisable, as manganese dioxide often contains small quantities of sulphur.

Comparative experiments show that the method yields results identical with those given by Eschka's process, which is the one generally employed, and has the advantage over the latter of occupying much less time. T. H. P.

Estimation of Sulphur in Sulphites. By A. BOURGOUGNON (*J. Amer. Chem. Soc.*, 1899, **21**, 469—470).—The weighed sulphite is dissolved in water, and to the solution is added a sufficient quantity of a mixture of water, hydrochloric acid, hydrogen peroxide, and barium chloride. After gentle heating, the sulphuric acid is estimated in the usual way. As commercial hydrogen peroxide frequently contains sulphuric acid, the reagent to be used may be prepared as follows. Hydrated barium peroxide is added in small quantities at a time to very dilute hydrochloric acid until the liquid is alkaline, alumina and ferric oxide being thus precipitated; the liquid is filtered, and the filtrate, collected in hydrochloric acid, is ready for use. T. H. P.

Estimation of Sulphuric Acid, with Especial Reference to the Estimation of Sulphur in Iron Ores and the Products of the Metallurgy of Iron. By C. Meineke (*Zeit. anal. Chem.*, 1899, **38**, 209—217).—To obviate the well-known error in the estimation of sulphuric acid in solutions containing much ferric chloride, the latter is reduced by zinc. To apply the method to pyrites residues, 2·5 grams of the substance is dissolved in hydrochloric acid and potassium chlorate; the chlorine is expelled; zinc in the form of granules or coarse filings is added, and when reduction is complete the solution is filtered and is then ready for precipitation with barium chloride. A pure white precipitate is obtained, the weight of which agrees closely with that obtained by Schröder's more tedious, but admittedly accurate, method of fusion with sodium carbonate and potassium chlorate. The same process serves for the estimation of sulphur in pig-iron, and the results are identical with those yielded by the author's cupric chloride method (Abstr., 1871, 89). M. J. S.

Volumetric Estimation of Combined Sulphuric Acid. By Félix Marboutin and Marcel Molinié (*Bull. Soc. Chim.*, 1898, **19**, [iii], 713—714 and 714—717).—Marboutin's volumetric method for estimating combined sulphuric acid (Abstr., 1898, ii, 254) is preferable to Telle and Robin's (Abstr., 1898, ii, 451 and 452), the appreciable solubility of barium chromate not having been taken into account in the latter; the error thus introduced may amount to 10 per cent. on the SO_3 present.

Marboutin's method of estimating combined sulphuric acid may be applied to a water containing organic matter, provided that it is evaporated with dilute nitric acid, and the residue treated with the fuming acid. The excess of nitric acid is removed by evaporating to dryness in the presence of hydrochloric acid, and the final residue is extracted with water and treated in the manner previously described (Abstr., 1898, ii, 254). As an alternative method, the organic matter is destroyed by Villiers' method (Abstr., 1898, ii, 492); the sulphuric acid is then estimated gravimetrically, because the presence of the manganese or vanadium salts employed would interfere with the volumetric process. In order to ensure rapid filtration, the liquid and the precipitated barium sulphate are digested for 12 hours at 40°.

G. T. M.

Influence of Hydrochloric Acid on Titrations with Sodium Thiosulphate, with Especial Reference to the Estimation of Selenious Acid. By John T. Norton, jun. (*Amer. J. Sci.*, 1899, [iv], **7**, 287—293; *Zeit. anorg. Chem.*, 1899, **20**, 221—229).—Relatively large quantities of sodium thiosulphate can be accurately titrated with iodine in the presence of hydrochloric acid only under special conditions. The temperature of the solution must be maintained as near 0°, and the titration must be performed as quickly as possible. If the quantity of thiosulphate does not exceed 20 c.c. of *N*/10 solution, it can be easily titrated in the presence of an amount of hydrochloric acid not exceeding 10 c.c. If, however, a large quantity of thiosulphate is present, a smaller quantity of hydrochloric acid must be used, and the solutions must be considerably diluted. An increase in the quantity of hydrochloric acid, the time taken for titration, and an increase in the temperature of the solution, all tend to give results above the correct one.

The estimation of selenious acid by means of thiosulphate and iodine is accurate when the above conditions are maintained. The quantity of thiosulphate solution must not exceed 20 c.c. of an *N*/10 solution, the hydrochloric acid must not exceed 10 c.c. (sp. gr. 1·12), and the solution before beginning the titration must be diluted to 400 c.c. If only 5 c.c. of hydrochloric acid are used, the solution need not be diluted to more than 200 c.c.

Muthmann and Shäfer (Abstr., 1893, ii, 318) estimate selenious acid by adding to the solution an excess of potassium iodide containing hydrochloric acid and titrating the liberated iodine with thiosulphate solution. The author finds that accurate results are more easily obtained by employing a larger excess of potassium iodide and then estimating the precipitated selenium gravimetrically. E. C. R.

Possible Error in the Estimation of Nitrogen in Nitrates due to Impurities in Reduced Iron. By B. L. Hartwell and Homer J. Wheeler (*J. Amer. Chem. Soc.*, 1899, **21**, 468—469).—The Ulsch method of estimating nitrogen in nitrates involves the use of reduced iron, a so-called chemically pure specimen of which the authors find to contain some nitrogenous substance. The error caused is very appreciable. A similar case has been investigated by Brandt (*Chem. Zeit.*, 1899, **23**, 22), who found that the impurity is removed by heating the iron in a current of hydrogen, but not by extraction with water, alcohol, or ether. T. H. P.

Modification of Pierce's Method for the Estimation of Arsenic in Ores. By J. F. Bennett, jun. (*J. Amer. Chem. Soc.*, 1899, **21**, 431—435).—About half a gram of the finely powdered ore is mixed with from six to ten times its weight of a mixture of equal parts of sodium carbonate and potassium nitrate and the mass gradually heated to fusion, which is maintained for some minutes. On cooling, it is extracted with boiling water and filtered; the filtrate, containing the arsenic as alkali arsenate, is strongly acidified with acetic acid, and boiled to expel carbonic anhydride. After cooling, phenolphthalein is added, then sodium hydroxide solution until alkaline, and finally acetic acid until just acid; a slight excess of silver nitrate solution is now added, the liquid being kept stirred and the precipitate allowed to settle, exposure to direct sunlight being avoided. After a few minutes, the clear liquid is poured on to the filter, the precipitate being washed with cold water first by decantation and finally on the filter. The precipitate is then dissolved in fairly concentrated nitric acid, the solution made up to 100 c.c. and titrated with standard thiocyanate; the silver may also be determined by igniting the filter and precipitate and cupelling. T. H. P.

Estimation of Arsenic in Glycerol. By A. C. Langmuir (*J. Amer. Chem. Soc.*, 1899, **21**, 133—136).—The organic matter is oxidised by evaporation with a mixture of 200 c.c. of nitric acid and 12 c.c. of sulphuric acid; the residue is transferred to a Marsh's apparatus, and the arsenic separated by heating the escaping gas, when a mirror is formed in a constricted part of the exit tube. The tube is cut and weighed to 0·01 milligram on an assay balance, then dipped in hot dilute nitric acid to remove the arsenic, and again weighed. In a trial experiment, 0·50 milligram of arsenic was taken and 0·45 milligram separated and weighed.

A rough estimate of the amount of arsenic may be obtained by adding zinc and hydrochloric acid to the diluted glycerol in a test-tube which is closed by a loosely-fitting cork covered with a filter paper; the filter paper is moistened with mercuric chloride, and shows a yellow stain if arsenic is present. The stain is permanent, and a series of specimens may be kept showing the coloration with different weights of arsenic. The colour is quite distinct with 0·01 milligram of arsenic, and is perceptible with 0·0025. T. M. L.

Tests for Boric Acid. By Victor Lenher and James S. C. Wells (*J. Amer. Chem. Soc.*, 1899, **21**, 417—420).—Of the various qualitative tests for boric acid, the pink coloration given to turmeric paper is the most delicate. An improvement on the ordinary method of carrying out the green flame test is to heat the mixture of borate, sulphuric acid, and alcohol in a test-tube fitted, by means of a cork, with a glass jet; the issuing gas is caused to impinge on the flame of a Bunsen burner, which then shows the characteristic green tint.

T. H. P.

Silica and Insoluble Residue in Portland Cement. By Porter W. Shimer (*J. Amer. Chem. Soc.*, 1899, **21**, 289—291).—In the estimation of silica in low-grade cements by solution in hydrochloric acid and evaporation to dryness, abnormally high results are often obtained, when compared with those obtained by the fusion method of estimating silica. This is due to the presence in the cement of unconverted silica and alumina, owing to the imperfect burning of the clay, and is a possible source of error in the analysis, but the difference between the silica determinations by the two methods may also be used as a test of the quality of the cement, since in a good sample the difference never exceeds 0·20 per cent., whilst in poor samples it may amount to as much as 4·5 per cent. T. M. L.

Use of Compressed Oxygen and Soda-lime in Organic Analysis. By Francis G. Benedict and Olin F. Tower (*J. Amer. Chem. Soc.*, 1899, **21**, 389—398).—The authors recommend compressed oxygen drawn directly from the steel cylinder for use in combustions. The device for regulating the flow of the gas consists of a T-piece so arranged that one end of the cross-tube dips about 1 inch under mercury, the other end being connected to the purifying apparatus; the rate of flow is then adjusted by a pinch-cock on a piece of rubber tubing, any slight excess of oxygen escaping through the mercury trap. For removing carbonic anhydride from the oxygen and for collecting that produced in the combustion, soda-lime prepared as follows gives good results: 1 kilogram of commercial caustic soda is treated in an iron vessel with about half a litre of water; to the thin paste formed, while still hot, is added 1 kilogram of coarsely-powdered quicklime, the mixture being well-stirred; the mass soon heats and must be stirred and the lumps broken up. When cool, it is ready for use. U-Tubes packed with such soda-lime not only absorb carbonic anhydride as effectively as potash bulbs, but are cheaper and more easily manipulated. T. H. P.

Estimation of Combined Carbonic Acid or Calcium Carbonate in Soils. By ALBERT STUTZER and R. HARTLEB (*Zeit. angew. Chem.*, 1899, 448—451).—The authors estimate the amount of calcium carbonate in soils by distilling with a solution of ammonium chloride, taking care that there is at least 10 parts of the latter to one part of calcium carbonate. Ammonium carbonate is liberated, and is, as usual, collected in standard acid and titrated. A check analysis should be made by distilling without addition of ammonium chloride.

Any magnesium carbonate counts as calcium carbonate. Ferrous carbonate, which interferes with the process, may be decomposed by boiling the soil with water for half an hour. The process has been tested side by side with the old method of liberating the carbonic acid and absorbing it in aqueous potash, with satisfactory results. L. DE K.

Flame Reaction of Potassium in Silicates. By GRENVILLE A. J. COLE (*Geol. Mag.*, 1898, 5, 103—106).—In Szabó's approximate quantitative estimation of alkalis in silicates by the flame test, the assay is mixed with gypsum. In place of gypsum, sodium carbonate is here suggested, and the flame is viewed through a plate of blue glass 5 mm. thick. Three grades, corresponding with about 4, 8, and 12 per cent. of potash respectively, are distinguished by the intensity of coloration of the violet flame. L. J. S.

Estimation of Potassium as Perchlorate. By F. S. SHIVER (*J. Amer. Chem. Soc.*, 1899, **21**, 33—42).—The author has investigated the perchlorate method of estimating potash, and finds that the modification of Caspari's method (Abstr., 1893, ii, 390), proposed by Kreider (Abstr., 1895, ii, 414), in which the perchlorate is filtered through a Gooch crucible, gives good results. T. H. P.

Estimation of the Lime, Potash, and Phosphoric Acid Probably Available for Ensuing Crops (on Hawaiian Soils). By WALTER MAXWELL (*J. Amer. Chem. Soc.*, 1899, **21**, 415—417).—The author considers that in the analysis of soils, the solvent employed should be similar to those operating in the natural processes of soil disintegration and plant food preparation. Such a solvent is aspartic acid, which dissolves phosphoric acid, lime, potash, and other bases from the soil in almost the same proportions as those found in the "waters of discharge," and in which they are removed by cropping. The method employed is as follows. To 200 grams of air dried soil, 1 litre of 1 per cent. aspartic acid solution is added, and the mixture gently shaken every quarter of an hour for 9 hours. After standing for 24 hours, the liquid is filtered, and a definite volume of the filtrate evaporated to dryness and gently ignited to destroy organic matter. The residue is twice moistened with hydrochloric acid, evaporated to dryness, dissolved in water, and filtered. The iron and aluminium are removed by precipitation with ammonia, and the lime and potash determined as usual. The phosphoric acid in the ammonia precipitate is estimated in the ordinary way. T. H. P.

Estimation of Zinc. By A. C. Langmuir (*J. Amer. Chem. Soc.*, 1899, **21**, 115—119).—For the estimation of zinc, the separated sulphide is redissolved in hydrochloric acid, the solution is boiled down with nitric acid, and the nitrate is converted into oxide by strong ignition in a weighed platinum dish. The recommendation is made that the zinc sulphide precipitate should not be washed, but a correction made, subsequently if the zinc oxide is found to contain traces of iron, calcium, or magnesium, or if any sulphate remains after ignition.

For the analysis of alloys containing copper, tin, lead, iron, and zinc, the nitric acid solution is evaporated to dryness and the tin is separated by redissolving in nitric acid; the copper and lead are then separated by electrolysis of the solution, which should contain 5 to 10 c.c. of concentrated nitric acid in 150 to 200 c.c. of water; the solution is then evaporated to dryness and ignited in a weighed platinum dish; if iron or nickel is present, it is estimated subsequently, and the values obtained are deducted from the weight of the zinc oxide. For the estimation of zinc in impure spelter, the lead is separated by electrolysis of the nitric acid solution, and the zinc nitrate is converted into oxide as before; the iron is then estimated by titration, and a corresponding correction made in the weight of the zinc oxide; if cadmium and arsenic are present, it is necessary to effect a separation by means of hydrogen sulphide. T. M. L.

Estimation of Zinc in Ores containing Aluminium. By Edmund Jensch (*Zeit. angew. Chem.*, 1899, 465—467).—It is well known that in separating zinc from iron, manganese, or aluminium by means of ammonia, the precipitate retains zinc which may, however, be recovered by dissolving in acid and reprecipitating with ammonia. It is now shown that in the presence of much alumina, the process of redissolving and reprecipitating should be repeated not less than four times in order to extract all the zinc. L. de K.

Colorimetric Estimation of Copper. By Maurice Lucas (*Bull. Soc. Chim.*, 1898, [iii], **19**, 815—817).—Objection is taken to the use of ammonium nitrate and to other modifications recommended by Jagnaux (*Analyse chimique*, 451) in the estimation of small quantities of copper by the depth of the colour produced on adding potassium ferrocyanide solution, the evaporation of the hydrochloric acid solution to dryness, and dissolution of the residue in water being considered preferable. The process is suitable for the estimation of the copper deposited electrolytically from solutions of iron and steel, and also for the estimation of oxygen in commercial copper. For the latter purpose, the metal is treated with silver nitrate solution, the precipitate boiled with 5 per cent. hydrochloric acid to dissolve the basic copper nitrate, and the copper subsequently deposited by electrolysis and estimated colorimetrically. N. L.

Separation of Copper from Antimony. By Maurice Lucas (*Bull. Soc. Chim.*, 1898, [iii], **19**, 817—819).—The mixed sulphides of the metals are treated with sodium sulphide solution, the liquid warmed with hydrogen peroxide to destroy polysulphides, and submitted to repeated electrolysis by Classen's method, until deposits consisting only of copper are produced. The metallic deposits are dissolved in nitric acid, the solution mixed with ammonia and ammonium sulphide, the precipitated copper sulphide separated by filtration, redissolved, and the copper estimated colorimetrically by the method previously described (preceding abstract). The small quantity of copper thus determined is deducted from the total weight of the antimony–copper deposit, and added to that of the copper corresponding with the copper sulphide remaining in the electrolytic cell, which, after the greater part of the sodium sulphide has been destroyed by adding hydrogen peroxide, is collected and estimated in the usual manner. The test analyses quoted are very satisfactory.

N. L.

Electrolytic Estimation of Lead in the Commercial Metal and in Alloys. By Auguste Hollard (*Bull. Soc. Chim.*, 1898, [iii], **19**, 911—915).—Careful study of the conditions which it is necessary to maintain in the accurate estimation of lead has shown that closely adherent deposits of lead peroxide may be obtained by electrolysis for 24 hours with a current of 0·15 ampère between an anode formed by a platinum cone and a cathode consisting of a spiral of platinum wire. The solution, measuring about 350 c.c., should contain 80 c.c. of free nitric acid, and not more than 0·2 gram of lead. In order that the deposit may have exactly the composition PbO_2, it is absolutely necessary that it should be dried at 200° for 15 minutes. The process is applicable to the estimation of lead in its alloys with zinc and tin, but not to those containing antimony, the oxide of this metal being deposited along with the lead peroxide. In the presence of copper, as in the analysis of brass and bronze, a part of the oxygen required for the peroxidation of the lead is derived from the copper nitrate present in the solution, and it is therefore necessary to reduce the free nitric acid to 14 c.c. per 350 c.c. of solution, and, at the same time, to increase the current to 0·3 ampère. N. L.

Volumetric Estimation of Mercury by Alkaline Arsenite. By W. Feit (*Zeit. anal. Chem.*, 1899, **38**, 242).—The author claims priority (Abstr., 1889, 927) as regards the method described by Reichard (this vol., ii, 183). M. J. S.

Separation of Manganese Oxide, Magnesia, and the Alkaline Earths. By Antoine Villiers (*Bull. Soc. Chim.*, 1898, **19**, [iii], 710—713).—Notable quantities of these oxides are precipitated when a ferric salt is added to an acetic acid solution of their phosphates, and when a mixture of recently precipitated ferric and calcium phosphates is treated with acetic acid only a portion of the calcium passes into solution. The quantitative separation of phosphoric acid from these oxides by the ferric phosphate method is only possible when the iron is present in considerable excess. The solution under examination is evaporated with hydrochloric acid to remove silicic acid, and ignited to remove organic substances; this treatment destroys oxalic acid, but when manganese is present, this acid may be oxidised to carbonic anhydride by warming the solution with aqua regia. Phosphoric acid being present, the solution is partially neutralised with ammonia, and the slight precipitate produced is redissolved in the least possible amount of hydrochloric acid. Unless iron is present in sufficient excess, the addition of an alkali acetate produces a precipitate of ferric phosphate; if a turbidity appears, ferric chloride is added until the phosphate is redissolved; the solution should remain clear on adding a further quantity of alkali acetate. The solution is boiled, and if the supernatant liquid retains the colour due to ferric salts, more alkali acetate is added; the ferric phosphate should be filtered as rapidly as possible, otherwise traces of iron will pass into solution owing to the action of atmospheric carbonic anhydride; these are removed by boiling the solution and repeating the filtration. The filtrate, when rendered ammoniacal, yields a precipitate which is added to the preceding, and the whole examined for aluminium and chromium; the final filtrate contains manganese, the metals of the alkaline earths, and magnesium; these are separated by the ordinary methods.

G. T. M.

NOTE.—The author does not include zinc, nickel, or cobalt in this scheme of analysis, because their phosphates remain dissolved, providing that ammonium chloride and ammonia are present in sufficient excess. This condition is one which is not usually realised in practice.

G. T. M.

Rapid Estimation of Tungsten in Steel. By GEORGE AUCHY (*J. Amer. Chem. Soc.*, 1899, **21**, 239—245).—In the estimation of tungsten, the amount of ferric oxide carried down by the tungstic acid is fairly constant and need not be separately estimated; it lies between 0·02 and 0·03 per cent. of the weight of tungsten when the latter is less than 1 per cent. of the steel, and between 0·03 and 0·04 for 1 to 2 per cent. of tungsten in the steel. To ensure accurate results, the solution from which the tungstic acid is filtered should contain as little free acid as possible, and the previous evaporation to dryness and dehydration of the silica should be made in hydrochloric and not in nitric acid solution. The phosphorus in tungsten steel may be estimated in the usual way if the amount is small, provided the yellow precipitate is not left for more than 2½ hours. T. M. L.

Analysis of Alloys Containing Tin and Antimony. By A. FRAENKEL (*Chem. Centr.*, 1899, i, 232; from *Mitt. Technol. Gewerb.-Mus., Wien*, [ii], **8**, 334—336).—The following process is suggested for the estimation of tin and antimony in the presence of lead, copper, and even phosphorus. After treatment with nitric acid, the insoluble residue is fused with sodium hydroxide in a silver crucible; the fused mass is extracted with water, one-third of its volume of alcohol is added to the extract, and after 24 hours the liquid containing the tin, and also any lead and phosphorus, is filtered from the insoluble residue, consisting of sodium metantimoniate and copper oxide (A). The filtrate is treated with hydrogen sulphide and the lead collected and weighed as sulphide; on adding acetic acid to the filtrate, tin bisulphide is precipitated and is converted, as usual, into dioxide and weighed; the phosphoric acid remains in solution and is estimated as usual. The insoluble matter (A) is dissolved in hydrochloric and tartaric acids, and after passing hydrogen sulphide, the copper and antimony sulphides are separated by means of ammonium sulphide.

The nitric acid solution is analysed by the ordinary process, the lead, copper, and antimony precipitates being respectively united with those recovered from the insoluble residue. L. DE K.

Analysis of Antimony Sulphide. By KITZING (*Chem. Centr.*, 1899, i, 59; from *Zeit. öffentl Chem.*, **4**, 830—833).—The following process is recommended for the analysis of *sulphur auratum. Total Sulphur.* Water is estimated by drying at 105—110°. 0·5 gram of the dried sample is mixed with 5 grams of tartaric acid and oxidised first with dilute and then with strong nitric acid; after 24 hours, a few c.c. of bromine are added and the mixture left overnight; if any unoxidised sulphur is then visible, a few crystals of iodine are added. After removing the bromine and nitric acid by repeated evaporation with hydrochloric acid, the residue is dissolved in hot dilute hydrochloric acid containing some tartaric acid, and the sulphuric acid precipitated as usual by means of barium chloride. *Free Sulphur.* 10 grams of the sample, dried at 105—110°, is extracted for 30 hours with ether in a Soxhlet apparatus, and the insoluble residue dried and weighed. *Antimony.* 0·2 gram of the dried sample is dissolved in a mixture of nitric and tartaric acids, &c., and the metal precipitated by means of hydrogen sulphide; the sulphide is afterwards converted into antimony dioxide by oxidation with fuming nitric acid and subsequent ignition. Owing to defective washing, the sample may contain some salts soluble in hot water; these may be estimated in the usual way. L. DE K.

Lacmoid, Phenacetolin, and Erythrosin as Indicators in the Determination of the Alkalinity of Water by Hehner's Method. By JOSEPH W. ELLMS (*J. Amer. Chem. Soc.*, 1899, **21**, 359—369).—By comparative titration of solutions of calcium and magnesium carbonates of known strength, using as indicators lacmoid, phenacetolin, and erythrosin, it is found that almost equally good results are obtained in each case, but that if uniformity within very narrow limits is required, the preference should be given to erythrosin. T. H. P.

Estimation of the Acidity of Urine. By GEORGES DENIGÈS (*Bull. Soc. Chim.*, 1898, [iii], **19**, 820—822).—The method for estimating the acidity of urine recently described by Lepierre (Abstr., 1898, ii, 652), is practically identical with a method, based on the observations of Maly, which the author described in a thesis published in 1884, and which he has subsequently improved. The following method of procedure is recommended. 20 c.c. of urine are mixed with 20 c.c. of $N/10$ sodium or potassium hydroxides, and 10 c.c. of a 10 per cent. solution of barium chloride and the liquid boiled, cooled, made up to 100 c.c., and filtered. 50 c.c. of the filtrate are then mixed with 10 c.c. of $N/10$ hydrochloric acid and the liquid titrated with $N/10$ soda, using phenolphthalein as indicator. N. L.

Acidity of Urine. By E. LÉPINOIS (*Bull. Soc. Chim.*, 1898, [iii], **19**, 822. Compare preceding abstract).—It is pointed out that the process for the estimation of the acidity of urine described by Lepierre is the same as that devised by Maly, and modified by Guichard and by Drouin. The process is, moreover, inexact, as has been shown by Lieblein (Abstr., 1895, ii, 55) and by the author (Abstr., 1896, ii, 397).
N. L.

Acidity of Urine. By CHARLES LEPIERRE (*Bull. Soc. Chim.*, 1898, [ii], **19**, 927—933. Compare preceding abstracts).—The author makes no claim to originality as regards the Maly-Denigès process for the estimation of the acidity of urine, and describes experiments with a solution of sodium dihydrogen phosphate which show that the best results are obtained by working in the cold, as originally proposed. If the liquid is boiled with alkali and barium chloride solution, as suggested by Denigès, more basic phosphate is precipitated than is the case at the ordinary temperature; the precipitate appears to have the composition $(PO_4)_2Ba_3,BaO$. A paper recently published by Lépinois (*Arch. méd. exp. et anat. path.*, 1898) is also criticised, and it is pointed out that much of the confusion which has arisen on the subject of the acidity of urine is the result of not clearly distinguishing between the absolute acidity, as measured by the number of replaceable hydrogen atoms, and the relative acidity, as determined by titration without the use of barium chloride, which depends on the nature of the indicator employed.
N. L.

Acidity of Urine. By H. IMBERT and A. ASTRUC (*Bull. Soc. Chim.*, 1898, [iii], **19**, 1016—1017).—Referring to the discussion between Denigès, Lépinois, and Lepierre on the acidity of urine (preceding abstracts), the authors express their full agreement with Lepierre's views on this subject, but they prefer to use calcium chloride instead of barium chloride for the precipitation of the phosphoric acid, since, as they have previously shown (*Soc. Biol.*, 1897; *J. Pharm.*, 1898), more accurate results are thus obtained.
N. L.

Volumetric Estimation of Hydrogen, Methane, and Nitrogen in Mixtures of Gases by Fractional Combustion with Copper Oxide. By ED. JAEGER (*Chem. Centr.*, 1899, i, 59—60; from *J. f. Gasbel*, 41, 764—766).—If a mixture of these three gases is left for some time in contact with copper oxide heated at 250°, the hydrogen is oxidised, whilst the methane is not affected. After noting the contraction, representing hydrogen, the gas is passed over red hot copper oxide, and the contraction, after absorbing the carbonic anhydride by means of aqueous potash, represents the volume of the methane.

The essential feature of the apparatus used by the author is a combustion tube placed between a Bunte's burette and a Hempel pipette. This tube is made from a glass tube 6 cm. long and 1 cm. wide by drawing out one end to a capillary tube to be connected with the burette, whilst the other end is drawn out so as to form a tube of 0·5 cm. width and 4·5 cm. length to be connected with the pipette. The tube is filled with powdered copper oxide, a small granule of the oxide being placed at the capillary end of the tube; both ends are also closed with a loose plug of asbestos. The tube is heated in a specially constructed furnace fitted with a thermometer. A blank experiment should be made once for all to allow for the volume of air contained in the tube, the oxygen of which also takes part in the combustion. The slight error caused by the fact that the reduced copper occupies a less volume than the copper oxide may be neglected. L. DE K.

Absorption of Methane and Ethane by Fuming Sulphuric Acid. By R. A. WORSTALL (*J. Amer. Chem. Soc.*, 1899, **21**, 245—250).—Contrary to the usual statement, methane and ethane are absorbed by fuming sulphuric acid. With a specimen of methane from methylic iodide, an absorption of 45·40 per cent. occurred in 11 days, and after 3 months 71·7 per cent. was absorbed, the acid becoming cherry-red in colour; with methane from natural gas, 24·3 per cent. was absorbed in 17 days, and 30·7 per cent. after 3 months. With a specimen of ethane from ethylic iodide, 70·5 per cent. was absorbed in 15 days, and 88·3 per cent. after 3 months. The absorption of methane in one hour is only slight, but in the case of ethane it might be sufficient to affect the analysis, and 15 minutes is probably the maximum of safety. T. M. L.

Detection and Estimation of Bromoform. By A. RICHAUD (*J. Pharm.*, 1899, [vi], **5**, 232—236).—An aqueous solution of potash is added to the liquid to be tested for bromoform and the mixture heated for 1½ hours in a reflux apparatus, the potassium bromide formed then being tested for, or estimated in, the usual way. If the liquid contains organic matter, it is first distilled, when the whole of the bromoform passes over with the first 75—100 c.c. of the distillate. The distillate is then heated with aqueous potash, evaporated to dryness, and carefully calcined to destroy any organic matter which may have distilled over. H. R. LE S.

Estimation of Ferrocyanides in Spent Gas-Purifying Material. By EDUARD DONATH and B. M. MARGOSCHES (*Zeit. angew. Chem.*, 1899, 345—347).—Fifty grams of the sample are washed with carbon bisulphide to remove free sulphur and the greater part of the tarry matters. When dry, the mass is digested in a litre flask with 150 c.c. of 15 per cent. aqueous caustic potash to decompose the ferrocyanides and afterwards diluted with water to 1030 c.c., the volume of liquid then being practically one litre. An aliquot part of the filtrate is taken, and the iron contained in the ferrocyanogen radicle is precipitated by boiling with an alkaline solution of bromine (80 grams of sodium hydroxide is dissolved in water; after cooling, it is made up to a litre and 20 c.c. of bromine added). The iron is precipitated as a fine cinnabar-red compound of doubtful composition; it must therefore be dissolved in dilute sulphuric acid, reduced with zinc, and titrated with permanganate, or it may be dissolved in hydrochloric acid, reprecipitated with ammonia, and weighed as oxide.

Instead of using brominated soda, potassium permanganate may be used, but the iron precipitate is then largely mixed with manganese, which complicates the analysis. One part of the metallic iron corresponds with 7·5476 parts of crystallised potassium ferrocyanide.

L. DE K.

Detection of Ethylic Alcohol in Ether. By Lassar-Cohn (*Zeit. anal. Chem.*, 1899, **38**, 251; from *Suddeutsch Apothek.-Zeit.*).—The ether is shaken with water, the aqueous layer removed, and freed from dissolved ether by careful warming. The alcohol remaining in the water is oxidised by manganese dioxide and sulphuric acid, the aldehyde produced is distilled off, and the distillate tested with Nessler's reagent. For quantitative estimation, the aqueous layer is warmed to 60°, and the ether expelled completely by a current of hydrogen; the liquid is then distilled and the distillate received in 10 c.c. of *N*/700 iodine solution. This liquid is then shaken with 10 c.c. of normal potassium hydroxide solution, when iodoform is produced, and the excess of iodine is titrated after acidifying with hydrochloric acid. M. J. S.

Analysis of Dynamite and Gelatin-Dynamite. By Frank W. Smith (*J. Amer. Chem. Soc.*, 1899, **21**, 425—431).—(*a*) Dynamite. The moisture is determined by drying in a desiccator over sulphuric acid for five days. A portion is extracted with ether until tissue paper, dipped in the ether and dried, no longer tastes of nitroglycerol; the residue, after drying at 80° for 2 or 3 hours, is weighed, the loss of weight *minus* the moisture giving the nitroglycerol. Next, the mass is extracted with cold water, which is finally displaced by acetone, so as to dry the residue without affecting any starch present, The loss in weight by the water extraction represents sodium nitrate. The remaining mass is ignited until free from carbon, the loss of weight giving the wood-pulp, flour, bran, &c. If much ash is present, it is extracted with hydrochloric acid. The loss on ignition, less the loss by the acid extraction, is called wood-pulp, and the basic magnesium carbonate is taken as twice the loss of weight by the acid treatment. The analysis may be checked by measuring in the nitrometer the volume of nitric oxide evolved by a known weight of the dynamite, and then taking separately the corresponding quantities of sodium nitrate and nitroglycerol, and measuring in each case the nitric oxide. Concordance in these measurements shows that the ether extracts nothing but nitroglycerol, and the water only sodium nitrate.

(*b*) Gelatin-Dynamite. The moisture is found as in (*a*). About 15 grams of the dynamite are extracted with chloroform in a Soxhlet apparatus, the loss in weight being nitroglycerol, sulphur, and resin. The residue is extracted with water to remove sodium nitrate and then with acetone, which dissolves out the guncotton. The wood-pulp and earthy absorbents remaining are treated as described under (*a*). The chloroform solution is evaporated until nearly all the solvent is removed, glacial acetic acid being then added, and the precipitated sulphur transferred to a Gooch crucible and treated with strong alcohol to remove the resin. The nitroglycerol is determined by repeatedly treating a portion of the dynamite with cold ether, the ethereal solution being allowed to evaporate spontaneously. The residue is washed into the nitrometer with acetic acid, and the nitroglycerol calculated from the volume of nitric oxide obtained. The resin may be estimated by difference. T. H. P.

Estimation of Dextrose. By Adolf Bickel (*Pflüger's Archiv*, 1899, **75**, 248—264).—In estimating dextrose, any boiling or concentration of aqueous solutions may lead to loss of sugar if the solution is alkaline; the reaction must therefore be acid, when no change occurs in dilute solutions. W. D. H.

Estimation of Dextrose by Lehmann's Method. By Léon Maquenne (*Bull. Soc. Chim.*, 1898, [iii], **19**, 926—927. Compare Abstr., 1898, ii, 264, 355).—In the estimation of sugar according to the method proposed by Lehmann, and more recently by Riegler, which consists in titrating by means of potassium iodide and thiosulphate the excess of copper remaining after treatment with Fehling's solution, it is found that the removal of the precipitated cuprous oxide by filtration may be omitted, thus rendering the process more rapid, without loss of accuracy. The following modified method of procedure is recommended. A quantity of the sugar solution containing less than 0·05 gram of glucose is added to 10 c.c. of Fehling's solution, and the liquid diluted with water to 30 c.c., boiled for 2 minutes, rapidly cooled, and mixed with 20 c.c. of sulphuric acid (50 per cent. by volume), and 10 c.c. of 10 per cent. potassium iodide solution. The solution is then immediately titrated with thiosulphate, using starch as an indicator, and the volume used deducted from that required in a blank experiment carried out in a similar manner with 10 c.c. of Fehling's solution. A table is given in the paper, showing the weight of inverted cane sugar corresponding with different volumes of 2 per cent. thiosulphate. N. L.

Estimation of Carbohydrates. By Frank W. Traphagen and W. M. Cobleigh (*J. Amer. Chem. Soc.*, 1899, **21**, 369—373).—100 c.c. of Fehling's solution, diluted with an equal volume of water, is heated on a water-bath and treated with the solution to be tested in the ordinary way. The precipitated cuprous oxide is collected and washed on an asbestos filter, the top layer of which, with the cuprous oxide, is removed, well stirred with water, and treated with 50 c.c. of a saturated solution of ferric sulphate in 20 per cent. sulphuric acid. When dissolved, the liquid is filtered through the same asbestos filter to remove any traces of cuprous oxide, and is then titrated with permanganate. The amounts of cane sugar and of starch corresponding with each c.c. of the permanganate solution must be previously determined by titrating with pure cane sugar and with a carefully analysed starch. The weight of cuprous oxide precipitated should be about the same in all cases, the method then giving reliable results. Experiments show that there is no danger of the cuprous oxide being oxidised, even if left on the filter all night, nor of its dissolution if left in contact with the alkaline liquid. T. H. P.

Estimation of Glycogen. By Jos. Weidenbaum (*Pflüger's Archiv*, 1899, **75**, 113—119). By Eduard Pflüger (*ibid.*, 120—247). —The methods at present in use for the estimation of glycogen are subjected to experimental criticism; Külz's method especially was examined, and considerable loss of glycogen was found to occur in its various stages. Some modifications are suggested, but even then the loss amounts to 12 per cent. W. D. H.

Detection of Caramel in Spirits and Vinegar. By Charles A. Crampton and F. D. Simons (*J. Amer. Chem. Soc.*, 1899, **21**, 355—358).—Spirits artificially coloured with caramel can be distinguished from those the colour of which is derived from long storage in cask by keeping the liquor for some time in contact with a definite quantity of Fuller's earth, and determining, by means of the tintometer, the percentage of colour removed; much more of the artificial colouring matter is absorbed than of the natural. Thus, for 40 samples of naturally coloured spirits, the mean percentage of colour removed was 14·6, the limits being 25·0 and 8·3 per cent.; whilst 18 samples of artificially coloured spirits gave a mean of 44·7 and a maximum and minimum of 54·1 and 40·0 per cent. respectively of colour removed. The test probably applies also to vinegars. T. H. P.

[Discrimination of Amber from Copal. Test for Arsenic in Carpets]. By Oscar Rössler (*Arch. Pharm.*, 1899, **237**, 239—240).—When a fragment of amber is heated in an ignition tube, the vapours evolved blacken lead acetate paper; this is not the case with copal. Judged by this test, the trinkets found at Troy and Mycenae are found to be carved out of amber, and not out of fossil copal.

Green carpets are coming into fashion again in Germany in consequence of the revival of the Empire style. They may be tested for arsenic by rolling up a fragment in a coil of platinum foil and heating it in the upper oxidising zone of the Bunsen flame under a glazed porcelain basin filled with cold water. A drop of silver nitrate solution is then drawn across the underside of the basin by means of a glass rod, and air is blown on to it after first passing over a glass stopper moistened with ammonia; a yellow precipitate indicates the presence of arsenic in the carpet. C. F. B.

Estimation of Oil and Spirit of Mustard. By Bruno Grützner (*Arch. Pharm.*, 1899, **237**, 185—189).—About 0·2 gram of the oil is dissolved in 10 c.c. of alcohol (or about 10 grams of the spirit are taken), mixed with 3·5 grams of ammonia and allowed to remain overnight in a stoppered vessel; the thiocarbimide is thus converted into the thiocarbamide. The whole is then rinsed into a beaker and heated on the water-bath until the ammonia has volatilised; a clear solution of sodium peroxide, free from sulphate, is added to the cooled liquid, which is then heated until no more oxygen is evolved, acidified with hydrochloric acid, and precipitated with barium chloride, the barium sulphate being weighed. From experiments with several samples, it was found that 1 gram of barium sulphate corresponds with 0·48021 gram of the pure natural oil.

The sulphate may also be precipitated with a weighed excess of barium chloride, or better, with a measured excess of $N/2$ barium chloride solution, the excess being estimated volumetrically. The liquid and precipitate are diluted to a total volume of 500 c.c., 250 c.c. are precipitated with sodium carbonate, the precipitate of barium carbonate (mixed with sulphate) is washed carefully, treated with a measured excess of $N/2$ hydrochloric acid and boiled, the excess of acid being then titrated with $N/2$ potassium hydroxide and phenolphthalein. Of the barium chloride solution, 1 c.c. corresponds with 0·02797 gram of the natural oil.

A specimen of artificial oil was found to contain only 0·4 per cent. more sulphur than the natural oil (28·6 per cent.). This oil boiled at 148—149·5°, had a sp. gr. 1·02 at 15°, and satisfied the requirements of the German pharmacopœia. It is thus impossible to distinguish in this way the artificial from the natural oil. C. F. B.

Preparation of a Titrated Solution of Acetaldehyde. By Xavier Rocques (*Chem. Centr.*, 1899, i, 60—61; from *Ann. Chim. anal. appl.*, **3**, 365).—1·386 grams of aldehyde-ammonia which have been thoroughly extracted with ether and dried, are placed in a 100 c.c. measuring flask and dissolved in 50 c.c. of 96 per cent. alcohol; 22·7 c.c. of normal (alcoholic) sulphuric acid are added, which soon causes a precipitate of ammonium sulphate; the measure is filled to the mark with alcohol, an extra 0·8 c.c. being added to compensate for the volume occupied by the precipitate. After remaining overnight, the liquid, which contains exactly 1 per cent. of aldehyde, is filtered. The solution may then be further diluted with water or proof-spirit, so as to contain exactly 0·050 gram of aldehyde per litre.

L. de K.

Separation and Estimation of Coumarin and Vanillin in Flavouring Extracts. By William H. Hess and Albert B. Prescott (*J. Amer. Chem. Soc.*, 1899, **21**, 256—259).—The alcohol is removed by heating at 80°, lead acetate is then added so long as a precipitate forms, and the filtered solution is extracted with ether. The vanillin in the ethereal extract is extracted with ammonia, and after neutralising with 10 per cent. hydrochloric acid and drying below 55°, is taken up with light petroleum and evaporated in a weighed dish. The coumarin is similarly separated by evaporating the ethereal solution below 45°, extracting with light petroleum, and evaporating in a weighed dish. The vanillin and coumarin are identified by their melting points. T. M. L.

Estimation of Acetic Acid in Commercial Acetates, and the Separation of Acetic, Propionic, Butyric, and Formic Acids. By K. R. Haberland (*Zeit. anal. Chem.*, 1899, **38**, 217—226).—The method for the estimation of acetic acid in calcium acetate adopted by the meeting of Industrial Chemists at Mombach is as follows:—About 10 grams of the pulverised substance are mixed with 50 c.c. of water in a 300 c.c. flask, and then treated with 11 c.c. of hydrochloric acid of sp. gr. 1·124. The mixture is distilled until the residue is syrupy; 50—60 c.c. of warm water added and the distillation again carried to dryness. In one-fifth of the distillate, the total acids are titrated by normal soda and phenolphthalein, and in one-tenth the hydrochloric acid is estimated by adding 15 c.c. of pure nitric acid and an excess of *N*/10 silver nitrate, and titrating the excess of silver in one-half of the filtrate by ammonium thiocyanate. The author confirms the accuracy of this method by proof analyses.

To estimate the four homologous acids in crude acetate, the substance is distilled with phosphoric acid and the distillate evaporated with lead oxide; the residue is dissolved in cold water and the solution heated to boiling. In consequence of its insolubility in boiling water, basic lead propionate is precipitated, whilst the other lead salts remain in solution and are separated by filtration. The filtrate is treated with sulphuric acid, evaporated to dryness with excess of zinc oxide, and the mass is then treated with a large volume of absolute alcohol. Zinc formate is completely insoluble in this liquid, and remains on the filter with the lead sulphate. The alcoholic filtrate is evaporated to dryness and distilled with phosphoric acid. The butyric and acetic acids may then be separated by either of two processes. They may be treated with silver carbonate and the aqueous solution of the silver salts evaporated on the water-bath, when, in consequence of the considerably lower solubility of silver butyrate, that salt crystallises out with almost quantitative completeness, leaving the silver acetate in solution. The other method is to convert the two acids into their amylic salts by cohobation with amylic chloride and a little 96 per cent. alcohol, and after distilling off the alcohol and the excess of amylic chloride at 100° to separate the salts by fractional distillation. A proof analysis gave numbers agreeing very closely with the amounts of the four acids employed.

It is incidentally shown that calcium acetate cannot be completely dehydrated at any temperature up to that at which it decomposes.

M. J. S.

Detection of Salicylic and Benzoic Acids in Milk. By G. Breustedt (*Arch. Pharm.*, 1899, **237**, 170—172).—25 c.c. of milk are mixed with 25 c.c. of water and 10 c.c. of Fehling's copper sulphate solution, about 2·5 c.c. of *N*-potash added, so that the liquid remains still perceptibly alkaline, and the mixture warmed for a little while in the water-bath, and filtered from copper caseinate and fat. The filtrate is mixed with a few drops of dilute hydrochloric acid, and shaken with ether, the ethereal extract being evaporated. In the residue, salicylic acid can be detected by the violet coloration with dilute ferric chloride solution; benzoic acid, by the brown flakes formed when the residue is dissolved in a little water and boiled with ferric chloride; or, in the presence of salicylic acid, by adding two drops of dilute formic acid and then excess of milk of lime, evaporating, and heating the residue in an ignition tube, when a smell of benzaldehyde is noticed. Salicylic acid can be detected still more easily by heating 10 c.c. of milk with 10 c.c. of fuming hydrochloric acid until a red coloration appears, cooling, shaking with 20 c.c. of ether, evaporating the ethereal extract, shaking the residue vigorously with a little hot water, filtering, and adding ferric chloride to the filtrate.

C. F. B.

Analysis of Condensed Milk. By F. S. Hyde (*J. Amer. Chem. Soc.*, 1899, **21**, 439—444).—The whole contents of a tin of the milk are mixed until of the same consistency throughout and a stock solution prepared by mixing 25 grams of the milk with 75 grams of water. The total solids are found by evaporating five grams of the solution and drying the residue at 100°. The percentage of fat is obtained by absorbing a known weight of the solution by an Adams' coil, which is dried and extracted with ether in a Soxhlet apparatus The milk sugar is determined by titration with Fehling's solution The cane sugar is obtained by boiling the stock solution with citric acid, which inverts the cane sugar but not the milk sugar; the solution is cooled, neutralised with potassium hydroxide solution, made up to a known volume, and titrated with Fehling's soultion. The reduction corresponds with a certain amount of cane sugar from which must be subtracted the milk sugar in terms of cane sugar. The proportion of milk solids is found by deducting the cane sugar from the total solids, and the percentage of water by subtracting the percentage of total solids from 100. The difference between the milk solids and the sum of milk sugar and fat represents casein, albumin, and salts. The ash is obtained in the usual way by ignition of the total solids. The 'degree of condensation' is rather a vague quantity, and is usually taken as the percentage of milk solids divided by 12·5, which is the average for cows' milk. T. H. P.

The Heat of Bromination Test for Oils. By AUGUSTUS H. GILL and ISRAEL HATCH, jun. (*J. Amer. Chem. Soc.*, 1899, **21**, 27—29).—This test is carried out in a calorimeter consisting of a flat-bottomed glass tube which is held in a beaker by means of a cork, a protecting air-jacket being thus produced, further insulation being obtained by arranging the beaker inside a larger one, and filling the space between with cotton waste. 5 c.c. of a 20 per cent. solution of the oil in carbon tetrachloride are run into the calorimeter and the temperature read off when constant. 5 c.c. of a solution of 1 volume of bromine in 4 volumes of carbon tetrachloride are then allowed to flow down the sides of the calorimeter and mix with the oil, the highest temperature shown by the thermometer being noted. To make the results given by different calorimeters comparable, sublimed camphor is used as a standard; on dissolving 7·5 grams of this substance in carbon tetrachloride and brominating it, a mean rise in temperature of 4·2° is obtained. Then, for each oil examined, the rise of temperature on bromination divided by 4·2 gives the specific temperature reaction, which on multiplication by an empirical factor (the mean for a number of oils of the iodine number divided by the specific temperature reaction), gives the iodine value. The method gives good results except in the case of hydrocarbon oils. T. H. P.

Constants of American Linseed Oil. By AUGUSTUS H. GILL and AUGUSTUS C. LAMB (*J. Amer. Chem. Soc.*, 1899, **21**, 29—30).—The authors have determined the constants for a number of specimens of pure American linseed oils and of menhaden oil, which is used both as a substitute and as an adulterant for linseed oil. The determinations include specific gravity, Valenta test, Maumené test, iodine absorption in 4 and in 18 hours, and a drying test. The Maumené and iodine numbers obtained are respectively about 10 and 4 per cent. lower than the usually accepted values. The effect of the menhaden oil is to raise the Maumené number, to lower the iodine value, and to retard the drying of the oil. Contrary to the statement of Dieterich (*Jour. Soc. Chem. Ind.*, 1893, 381), the iodine value is not generally appreciably increased by 18 hours standing. T. H. P.

Analysis of Sod Oil. By **Erastus Hopkins, D. L. Coburn,** and **Edward Spiller** (*J. Amer. Chem. Soc.*, 1899, **21**, 291—300).—Sod oil or dègras is the waste fat obtained in the chamoising process and is used for currying purposes, that is, dressing bark-tanned leather; analyses of 12 samples are given. The moisture is determined by absorbing the oil with filter papers and drawing air over it at 100°, and ranges from 1 to 40 per cent. of the oil. The oil is then extracted in a Soxhlet apparatus with light petroleum boiling at 40°, which dissolves from 58 to 96 per cent. of the oil; the soap is next extracted with absolute alcohol, and amounts to 0·7 to 8·8 of the oil; the insoluble residue, after deducting the weight of ash, represents the quantity of hide fragments, 0·15 to 3 per cent., in the oil. The quantity of ash is large, owing to the extraction by the oil of the ash of the leather, and is especially rich in calcium salts from the 'liming' of the leather; the quantity varies from 0·05 to 1·04 per cent. The 'dègras former,' which is regarded as the valuable constituent of the oil, is readily saponified; the soap is precipitated by an excess of salt, and acidified with hydrochloric acid, the "dègras former" which separates is then washed with water and light petroleum, dissolved in absolute alcohol, and evaporated in a weighed dish; it is thus obtained as a resinous substance melting at 65—67°, and amounts to 1 to 26 per cent. of the dry oil. Values are also given for the free mineral acid, the free fatty acid, the quantity of ethereal salts, the Reichert-Meissl number, the iodine number, the non-saponifiable matter and its iodine number, each value being calculated for the original oil, the dry oil, and the oil soluble in light petroleum. The wide variation in properties is due to the fact that a number of different oils are used for the manufacture of sod oil, the two principal ones being menhaden and cod oils.

T. M. L.

Estimation of Alkaloids by Iodine Solution. By **Karl Kippenberger** (*Zeit. anal. Chem.*, 1899, **38**, 230—236).—In support of his view that the formation of the periodides of the alkaloids does not take place in accordance with the equation $Alk,HCl + KI + I_2 = Alk,HI,I_2 + KCl$ (Abstr., 1896, ii, 282, 682), but that the hydrogen iodide in the product is, at least in part, derived from the decomposition of water by the free iodine, the author states that the periodide of narcotine can be produced by the action of iodine on narcotine hydrochloride in the absence of an alkali iodide. He, however, practically abandons his earlier contention that the conditions of the reaction can be so arranged as to involve the consumption of a uniform molecular proportion of iodine, and insists on the necessity of standardising the iodine solution in each case by means of weighed amounts of the special alkaloid to be estimated.

M. J. S.

The Volumetric Estimation of Alkaloids. By **O. Linde** (*Arch. Pharm.*, 1899, **237**, 172—185).—This paper is the first instalment of an account of the various volumetric methods employed for the estimation of alkaloids. General methods are first discussed, and amongst these in the first place the method of precipitation with potassium mercuriodide solution ("Mayer's reagent"). It is pointed out that the precipitate formed has no definite composition; that an allowance has to be made for its solubility; that the end point of the reaction is affected by the presence of acid (sulphuric), and also by the concentration of the alkaloid in the solution titrated; moreover, that other substances contained in extracts of plants, beside the alkaloids, are precipitated by the mercuriodide solution. The methods of precipitation with phosphomolybdate and with mercuric chloride solutions are then discussed, and are found to be open to objections of the same kind. C. F. B.

Assay of Nux Vomica. By EDWARD R. SQUIBB (*J. Amer. Chem. Soc.*, 1899, **21**, 351—355).—10 grams of the ground seed are extracted with cold 10 per cent. acetic acid, and the liquid evaporated to dryness in a flat-bottomed capsule on a water-bath. To the dry extract are added 10 c.c. of a mixture of 2 vols. of 91 per cent. alcohol, 1 vol. of 10 per cent. ammonia solution, and 1 vol. of water, and the mixture stirred until complete solution takes place. The liquid is then shaken with 40 c.c. of a mixture of equal volumes of chloroform and ether, allowed to settle, and the chloroform-ether solution separated. This extraction is repeated, twice if necessary, the whole of the liquid being evaporated to dryness in a tared flask. 10 c.c. of decinormal sulphuric acid are run into the flask and when the soluble alkaloids are dissolved, 20 c.c. of hot water and a definite quantity of logwood indicator are added, and the amount of alkaloids present calculated from the volume of decinormal potash necessary to give the liquid a pinkish tint.

T. H. P.

Valuation of Indigo. By WILHELM HOLTSCHMIDT (*Zeit. angew. Chem.*, 1899, 451—455; 475—479).—The assay of indigo by the present processes is not satisfactory. In the process of titration with permanganate, a serious error may be caused by secondary actions when the sample of indigo is treated with sulphuric acid (sulphonated) at 85°; but this may be avoided by adopting the author's cold process. 0·5—1 gram of the finely-powdered sample is treated in a test-tube with 10 c.c. of sulphuric acid, containing 40 per cent. of phosphoric anhydride, and the mixture well kneaded with a glass rod; the sulphonation is complete in about two hours, but it is safer to leave the mixture overnight in a desiccator. The solution is now poured into a measuring flask containing enough water to prevent any sensible development of heat, the tube is well rinsed with cold water, and the whole finally made up to 500 or 1000 c.c., filtered quickly, and 25 c.c. of the filtrate titrated with $N/100$ permanganate as follows: After diluting to about 125 c.c., the permanganate is added at the rate of 2 drops per second until the liquid is of a pale green colour, whilst on stirring, dark clouds are visible; 2 or 4 drops of the permanganate are now added at a time with gentle stirring, so as not to disturb the clouds, and the formation of fresh clouds is noticed. When no more are formed, the operation is finished, and 0·1 or 0·2 c.c. of permanganate is deducted from the total. A paraffin lamp may be used as the source of light for the titration. Donath and Strasser's improvement in the titration process (Abstr., 1895, ii, 300) is approved of by the author. This consists in freeing the sample from indigo-glue and indigo-red by successively digesting with dilute hydrochloric acid and alcohol-ether mixture before sulphonating. The presence of indigo-brown does not interfere with the subsequent titration with permanganate.

Voeller (Abstr., 1891, 1564) proposed to remove the indigo-brown also by treating the sample already freed from indigo-glue and indigo-red with dilute aqueous potash, and then to estimate the nitrogen in the purified indigotin by Kjeldahl's process. The author approves of this method, but recommends the use of a 1 per cent. solution of potassium hydroxide; too long contact with the alkali must be avoided, as otherwise indigo-brown is actually generated from the indigotin. A large number of analyses have been made and tabulated, showing the amount of nitrogenous matter extracted by the various solvents in use to purify the sample before submitting it to the Kjeldahl process. For convenience of comparison, the nitrogen due to the "glue" has been multiplied by the same factor as the other nitrogen.

Part of the paper is devoted to the technical testing of indigo by the colorimetric method, which, however, often fails to give exact indications owing to differences in shade and to the "wool test," which, although valuable to dyers, gives no indication of the true amount of indigotin.

L. de K.

Estimation of Albumin. By R. Delaunay (*J. Pharm.*, 1899, [vi], 3, 100—101).—The albumin in urine is not always completely precipitated by the addition of acetic acid and subsequent heating; if, however, the urine is previously saturated with sodium sulphate, the precipitation is complete; but it is necessary, before weighing the albumin, to wash it with boiling water until free from sulphates.

H. R. Le S.

General and Physical Chemistry.

Optically Transparent Liquids. By Walthère Spring (*Rec. Trav. Chim.*, 1899, **18**, 153—168).—Tyndall has assumed that when a beam of light passes through a gas its path is made evident by the illumination of minute solid or liquid particles present as impurities. Lallemand, however, from experiments with carefully distilled liquids, concluded that the illumination of a fluid medium by light is a specific property of the medium, and that each medium has a certain "coefficient of illumination," dependent on its nature. The author now shows that, although it is impossible to obtain a truly transparent liquid (that is, one which is not rendered luminous by the passage of a beam of light) by distillation or filtration, liquids can be rendered optically pure by means of a current of electricity; on passing, for example, a current through water containing a small quantity of silica or ferric hydroxide in suspension, the suspended matter is deposited at the cathode, and carries with it the minute particles which render the water capable of being illuminated. The same result is also obtained by adding clear lime water to a solution of silicic acid, and leaving the precipitate to subside in a stoppered vessel; on examining the liquid in a beam of light, care being taken that the vessel is not opened, it is found to be perfectly transparent. The subsidence of other gelatinous precipitates, such as the hydroxides of iron, aluminium, and zinc, from water renders the latter non-illuminable; the subsidence of crystalline precipitates, however, such as barium sulphate or calcium oxalate, gives no such result. It thus appears probable that the minute suspended particles can only be removed by being surrounded, during the precipitation, with a heavy, gelatinous envelope. The filtration of water through a layer of a gelatinous precipitate, out of contact with the air, renders it transparent; but if filtered in contact with air, this result is not obtained. The reason why distillation fails to yield transparent liquids is thus made evident.

In the case of organic liquids, the author has not obtained such definite results; the subsidence of gelatinous precipitates from organic liquids is, as a rule, very incomplete, so that optical transparency cannot generally be obtained. It appears probable also, that many organic liquids become luminous on the passage of a beam of light, owing to fluorescence.

The particles which are rendered luminous in water by a beam of light appear to consist largely of organic matter, but luminescence is also due to minute bubbles of gas; this is made clear by the increased illumination which occurs when the pressure in the space above the water is diminished, and by the fact that optically transparent water is rendered luminescent by passing air through it. W. A. D.

Influence of Elements on the Optical Activity of the Amyl Radicle. By Paul Walden (*J. pr. Chem.*, 1899, [ii], **59**, 470—473). —A claim of priority with regard to Brjuchonenko's work on this subject (this vol., ii, 265). R. H. P.

Interconversion of Optical Antipodes. IV. and V. By PAUL WALDEN (*Ber.*, 1899, **32**, 1833—1855; 1855—1864. Compare Abstr., 1896, i, 205; 1898, i, 127, 178).—IV.—When lævorotatory chloro- or bromo-succinic acid is acted on with bases, a mixture of lævo- and dextro-malic acids, in varying proportions, is produced. The sign and the specific rotatory power of the malic acid which is formed when different bases are used is shown in the accompanying table; the values given were determined in presence of a uranium salt, which has the effect of increasing the specific rotatory power of malic acid to ±460° (Abstr., 1898, ii, 149).

Halogen acid.	Hydrolysing agent.	Specific rotatory power of malic acid.
I. *l*-Chlorosuccinic acid	Ag_2O	$[\alpha]_D = -460°$
l-Bromo- „ „	H_2O	-212
l-Bromo- „ „	$TlOH$	-203
l-Bromo- „ „	HgO	-172
l-Bromo- „ „	Hg_2O	-130
l-Bromo- „ „	PdO	-125
II. *l*-Bromo- „ „	Tl_2O_3	± 0
III. *l*-Chloro- „ „	$RbOH$	$+440$
l-Chloro- „ „	KOH	$+425$
l-Chloro- „ „	NH_4OH	$+460$
l-Chloro- „ „	CuO	$+330$
l-Bromo- „ „	$Cd(OH)_2$	$+301$
l-Chloro- „ „	$Ba(OH)_2$	$+170$
l-Chloro- „ „	$Pb(OH)_2$	$+170$
l-Chloro- „ „	$NaOH$	$+150$
l-Chloro- „ „	$Sn(OH)_2$	$+130$
l-Chloro- „ „	$LiOH$	$+100$

The rotatory power of lævomalic acid is not altered when a solution in strong potassium hydroxide is kept in the dark during 16 months, and it also remains lævorotatory when boiled with dilute caustic potash during 36 hours, although it is not stated that the magnitude of the specific rotatory power is unaltered. From these experiments, and from similar experiments with inactive malic acid, the conclusion is drawn that no change of rotatory power takes place after the hydrolysis of the halogen-acid. For the most part, it is the stronger bases which bring about a reversal of rotatory power during hydrolysis, but no definite relationship can be traced between the influence of the base and its molecular volume, or the atomic volume of the metallic element, or its position in the periodic system. Alkalis have an optical effect in the opposite direction to that of water, and the formation of mixtures of dextro- and lævo-malic acids by the action of aqueous alkalis may be explained, to some extent, by the opposite influence of the two hydrolysing agents which are present; the effect of mixtures of bases is, however, somewhat irregular, since a mixture of silver oxide and potassium hydroxide gives a lævorotatory malic acid, whilst a mixture of silver oxide and ammonia gives a strongly dextrorotatory acid. The nature of the product is largely influenced by the conditions under which hydrolysis takes place; thus, lithium hydroxide acting on a solution of lævobromosuccinic acid in methylic alcohol (in which the base is only slightly soluble) gives an inactive acid, whilst in aqueous solution a dextrorotatory acid is formed.

It is suggested that the formation of two optical isomerides in the hydrolysis of active chloro- and bromo-succinic acids is probably due to differences in the mechanism of the reaction, one being a direct substitution of hydroxyl for halogen by the interaction of ions, and the other an indirect action depending on the formation of an intermediate additive product from the base and acid.

In general, it may be said that the strong bases cause a reversal of rotatory power, whilst feeble bases, which tend to form additive compounds, give a malic acid of similar rotatory power, but exceptions occur in the case of copper, cadium, lead, and tin oxides on the one hand, and thallous hydroxide on the other.

V.—The following actions have been described in the earlier papers:

I. *l*-Malic acid gives *d*-chloro- and bromo-succinic acids by the action of phosphorus pentachloride.

II. *l*-Aspartic acid and *l*-asparagine give *l*-malic acid by the action of nitrous acid.

III. *l*-Aspartic acid and asparagin give *l*-chloro- and bromo-succinic acids by the action of nitric oxide and chlorine or bromine.

IV. *l*-Chloro- and bromo-succinic acids give *l*-malic acid by the action of silver oxide, but *d*-malic by the action of potassium hydroxide.

Natural malic acid is described throughout as 'lævo,' although the free acid is dextrorotatory; the esters, amides, acetyl esters, the esters of methoxy-, ethoxy-, isopropoxy-, and isobutoxy-succinic acid, and the esters of nitromalic acid are lævorotatory, whilst among the derivatives only the chloro- and bromo-succinic esters, prepared by the action of pentachloride and pentabromide of phosphorus, are dextrorotatory. The change of sign on substituting chlorine or bromine for a hydroxyl or similar radicle is of very general occurrence, where the substitution is made directly on an active asymmetric carbon atom, and has been observed in the esters of *l*-mandelic acid, *d*-tartaric acid, *d*-lactic acid, *l*-α-hydroxybutyric acid, *l*-methylpropylcarbinol, *d*-methylamylcarbinol, and *l*-methylethylcarbinol; exceptions are found in the case of *l*-propylene glycol and the chloride of *l*-isobutylic α-hydroxybutyrate. The action of phosphorus pentachloride and pentabromide is therefore regarded as normal, and dextrorotatory chloro- and bromo-succinic acids are described as 'lævo.' The action of potassium hydroxide and allied bases (the third group in the table) is therefore normal, whilst silver oxide and the first group of bases have an abnormal optical influence, and bring about a change of configuration; the different behaviour of the cyanides, nitrites, cyanates, and sulphites of potassium and silver is quoted as an analogous case, the potassium salts acting directly, and the silver salts forming intermediate additive products.

It is open to question whether asparagine and aspartic acid have the configuration of dextro- or of lævo-malic acid; in the former case, the formation of lævomalic acid by the action of nitrous acid is an abnormal action, whilst in the latter case the formation of chloro-

and bromo-succinic acids by the action of nitric oxide and chlorine or bromine is abnormal.

If, instead of regarding as 'lævo' all acids which are derived directly from lævomalic acid or are converted directly into it, the sign of the rotatory power alone is considered, then optical inversion occurs in the action of phosphorus pentachloride and pentabromide, of nitrosyl chloride and bromide, of nitrous acid, and of potassium hydroxide and the third group of bases, and the only 'normal' action in which no inversion occurs is the hydrolysis by means of silver oxide and the first group of bases. T. M. L.

Theory and Application of a New Method of Interference Spectroscopy. By Ch. Fabry and A. Perot (*Ann. Chim. Phys.*, 1899, [vii], **16**, 115—144).—A physical paper, not suitable for abstraction. G. T. M.

A Photographic Investigation of the Absorption Spectra of Chlorophyll and its Derivatives in the Violet and Ultraviolet Region of the Spectrum. By C. A. Schunck (*Proc. Roy. Soc.*, 1898, **63**, 389—396).—Tschirch found (*Ber. deut. Bot. Ges.*, **10**, 76) that derivatives of chlorophyll show a characteristic absorption band in the ultraviolet region of the spectrum, occupying the same position as a similar band in hæmoglobin derivatives. The author, who has confirmed Tschirch's experiments, has examined a larger number of chlorophyll derivatives, and finds that in all of them there is a characteristic absorption between the solar lines F and M; this, in conjunction with the very similar absorption of hæmoglobin derivatives, is taken as supporting the view that chlorophyll and hæmoglobin have something in common. . The chief point in which the author's results differ from those of Tschirch is that the former finds that only some of the derivatives are characterised by the single band; some show two, or even three, bands. J. C. P.

Aluminium as an Electrode in Cells for Direct and Alternate Currents. By Ernest Wilson (*Proc. Roy. Soc.*, 1898, **63**, 329—347).—When a plate of aluminium is made the anode in a cell containing a solution of alum, it offers a great resistance to the passage of a current. Two electrodes, one of aluminium and one of carbon, were immersed in a saturated solution of alum and connected with twenty-two storage cells. When the aluminium was connected with the negative battery pole, the current was 3·6 ampères, and the potential difference between the electrodes was 4·4 volts; when the aluminium was connected with the positive battery pole, the current was zero, and the potential difference about 22 volts. The influence of temperature was found to be considerable, the potential difference in one cell sinking from 30 to 3 volts as the temperature rose from 13·5° to 70°.

A film, formed on the aluminium anode, seems to be the cause of the great resistance; this film, which analysis showed to be basic aluminium sulphate, was found to be a fairly high, although unstable, insulator. Two aluminium plates, with their films, were immersed in saturated and unsaturated solutions of sodium, ammonium, and potassium alums, and it was found that, with suitable current density and temperature, such a system made an efficient condenser.

It was thought that aluminium-carbon cells might serve to rectify an alternate current, but this expectation was not fulfilled with the cells and frequencies used. It was shown, however, that the half-period during which the electricity traversing the circuit was a minimum was that in which the aluminium acted as anode.

J. C. P.

Electromotive Efficiency of Carbonic Oxide. By VICTOR HOEPER (*Zeit. anorg. Chem.*, 1899, **20**, 419—451).—By combination with the normal electrode KCl | HgCl | Hg, the potential difference between platinum charged with carbonic oxide and a normal solution of hydrochloric acid is found to be – 0·70 to – 0·60 volt. When oxygen or air is passed in instead of carbonic oxide, the value is —1·1 to – 0·9 volt. These relative values agree with the E.M.F. of the combination Pt | CO | HCl | HgCl | Hg | HgCl | HCl | O | Pt, which is 0·45 volt; when carbon is substituted for platinum, a similar value is obtained. The effect of mixing air and carbonic anhydride with the carbonic oxide is determined, and from a theoretical discussion it appears probable that carbonic oxide is not indifferent to the oxygen, but unites with it largely to form carbonic anhydride.

The potential difference between platinum and cuprous chloride solution is essentially the same, whether the solution contains carbonic oxide or not. Thus the E.M.F. of the combination Pt | $CuCl_2$ | HCl | HgCl | Hg | HgCl | HCl | CuCl,HCl | Pt is 0·16 volt; when the cuprous chloride solution is charged with carbonic oxide, the E.M.F. is 0·135 volt. As before, carbon may be substituted for platinum. When the platinum electrode immersed in the cupric chloride solution is replaced by copper, the E.M.F. is 0·4 volt. This arrangement leads up to Borchers' element, Cu | CO | CuCl | O | C, the basis of which is the combination Cu | CuCl | C, with an E.M.F. of 0·45 volt. When carbonic oxide is introduced at the copper electrode, and oxygen at the carbon electrode, the E.M.F. is not appreciably affected. The oxygen, however, prevents the separation of copper at the carbon electrode, and thus the element cannot assume the form Cu | CO | CuCl | Cu, the E.M.F. of which is practically nil. The carbonic oxide is oxidised to carbonic anhydride at the copper electrode, and the latter is undiminished. Thus Borchers' element is able to give a continuous current.

J. C. P.

Connection between the Electrical Properties and the Chemical Composition of different kinds of Glass. By ANDREW GRAY and JAMES J. DOBBIE (*Proc. Roy. Soc.*, 1898, **63**, 38—44).—The authors, in conjunction with T. Gray (Abstr., 1885, 470), previously established the general result that the electrical conductivity of lead glass increases with the amount of soda present, and decreases as the percentage of lead oxide rises.

In the present investigation, the specific resistance and specific inductive capacity of several glasses, made specially for the investigation, have been determined. The two lead glasses examined were almost free from soda, and had a higher percentage of lead oxide

(43 per cent. and 47 per cent.) than any previously used; they both had an extremely high specific resistance—too high to be measured. Another glass, described as barium aluminium borosilicate, had the very high specific resistance (ohms) of above $59,000 \times 10^{10}$ at all temperatures up to 140°, thus behaving more like a lead glass than a lime glass. This glass shows scarcely any trace of dielectric polarisation. The effect that soda has in increasing the conductivity is shown in the case of a zinc soda 'Jena glass,' the specific resistance of which was $596{\cdot}5 \times 10^{10}$ at 43°, and $0{\cdot}200 \times 10^{10}$ at 140°.

The composition of each of the glasses examined is given in the paper. J. C. P.

Galvanic Polarisation in Solutions of Alkali Sulphates. By HANS JAHN (*Zeit. physikal. Chem.*, 1899, **29**, 77—88).—The polarisation in $N/8$ solutions of sodium, lithium, and ammonium sulphates was determined by the method previously employed by the author (Abstr., 1896, ii, 250; 1898, ii, 496). The values obtained are $N/8$ sodium sulphate, $E_{0^\circ} = 2{\cdot}55$ volts, $E_{40^\circ} = 2{\cdot}42$ volts; $N/8$ lithium sulphate, $E_0 = 2{\cdot}65$ volts, $E_{40^\circ} = 2{\cdot}45$ volts; $N/8$ ammonium sulphate, $E_0 = 2{\cdot}39$ volts, $E_{40^\circ} = 2{\cdot}23$ volts, the current varying from 0·0118 to 0·138 ampères. The author has previously shown that the polarisation is a function of the current, and the values obtained are found to be in good accord with those calculated by the use of his logarithmic formula $E = a + b \log I$, where I is the current strength. L. M. J.

Electro-affinity: a New Principle of Chemical Classification. By RICHARD ABEGG and GUIDO BODLÄNDER (*Zeit. anorg. Chem.*, 1899, **20**, 453—499).—The theory of valency and constitutional formulæ, so useful in systematising organic compounds, fail when applied to inorganic compounds. The chief characteristic of the latter is their electrolytic dissociation, and this suggests that the attraction between an atom and electron would provide a more general basis of classification than the attraction between one atom and another. A measure of this electro-affinity (intensity of union between atom and electricity) is given by the E.M.F. necessary to destroy the union between atom and electron. The E.M.F. required to decompose a salt is an additive property of the anion and cation, and thus for each ion a number can be given which expresses the intensity of its union with electron. The cations, Na, Mg, Al, Zn, Cd, Pb, H, Cu'', Ag, Hg', are arranged in the order of their decreasing electro-affinity, and so similarly are the anions Cl, Br, I. It is then shown that various properties of inorganic compounds, such as solubility, degree of dissociation, and tendency to form complex or molecular salts, vary with the electro-affinity.

A salt will in general be soluble in proportion to the ease with which it splits up into ions. An example of this parallelion between electro-affinity and solubility is found in the increase of solubility in the halogen compounds of mercury, silver, or lead from iodide to chloride. Exceptions, however, are to be found, and the authors point out that the ion-solubility is not a simple function of the electro-affinity; another factor is the energy required to dissolve the union between atoms of the same compound, and this atom-affinity increases enormously and rapidly in those cases where the electro-affinity is high. This explains probably why the alkali chlorides are less soluble than the iodides, and potassium salts in general less soluble than sodium salts.

The degree of dissociation of an electrolyte does not depend only on the electro-affinity of the component parts (sodium chloride and sodium iodide, for example, are dissociated to about the same extent); it depends also on the atom-affinity of the constituents and the solubility of the undissociated molecules. The electro-affinity and degree of dissociation may be more directly compared in the case of dibasic and tribasic acids, which are dissociated to a less extent than monobasic acids; the more numerous the charges an ion has to carry, the less will be the intensity with which they are held.

Parallelism is also traced between electro-affinity and the tendency to form complex compounds. In the latter, one of the ion-forming constituents is a molecular group, consisting of a 'single ion' (or ions), and an electrically neutral molecule ('neutral part'); thus in the anion $FeCy_6$, there are the single ions Cy_3 and the 'neutral part' $FeCy_3$. For the stability of such molecular groups, salts with weak ions will be the most suitable 'neutral parts,' and it is found accordingly that the tendency to the formation of complex compounds increases as the electro-affinity decreases. The alkali metals are scarcely ever found in 'neutral parts,' whilst magnesium, aluminium, iron, copper, and silver are so in an increasing degree. The fact that in the electrolysis of complex compounds the 'single ion' alone is liberated, shows that the electro-affinity of the complex ion is greater than that of the 'single ion'; thus the weaker an ion is, the more will it tend to strengthen itself by the addition of a 'neutral part.' This is seen in the series Cl, Br, I, CN, which show a gradually increasing tendency towards the formation of complex ions. Complex anions are more common than complex cations, because few anions have an electro-affinity comparable to that of the strong cations.

Another common 'neutral part' is ammonia, in the ammonia compounds of metallic salts; weak ions, such as copper and silver, have the greatest tendency to unite with ammonia. The addition of NH_3 to the relatively weak ion H forms the strong ion NH_4. Hydrates also can in this manner be classified along with molecular compounds, H_2O being regarded as a 'neutral part.' The comparison of migration velocities supports the view that the ions are hydrated. There is probably a close connection between hydrated salt and hydrated ions, and it is noted that the salts with the weakest ions show the strongest tendency to have water of crystallisation.

Werner has shown that the hydrates and ammonia compounds may be regarded from one standpoint, and the authors have now extended this view to all molecular compounds. J. C. P.

Apparatus for Electrolysis. By JOSEPH RIBAN (*Bull. Soc. Chim.*, 1899, [iii], 81—85).—In many electrolytic operations, it is important to know the current density, and this is usually determined from the formula $ND_{100}=i/S$, where i is the strength of current in ampères and S is the surface of the electrode in square decimetres.

In most cases, however, the current density is not the same over the whole surface of the electrode, and the above expression simply gives the mean value of this quantity; this is the case where conical and cylindrical electrodes are employed. In order to obtain a more uniform distribution of current density, the author advocates the use of hemispherical electrodes concentrically disposed, the outer electrode consisting of a platinum capsule, formed of a hemispherical portion, prolonged into a short cylindrical part, the inner electrode, which generally forms the anode, consisting of a platinum hemisphere surmounted by a cone. In this form of apparatus, the current intensity is constant for all sections of the electrode, except those at the surface of the liquid. The paper concludes with a description of clamps and supports suitable for electrolytic work. G. T. M.

Magnetic Susceptibility of Liquid Oxygen. By JOHN A. FLEMING and JAMES DEWAR (*Proc. Roy. Soc.*, 1898, **63**, 311—329).—When a substance is introduced into a magnetic field of variable strength, a mechanical force is exerted on it, which depends on its magnetic susceptibility. If f be this force, then $f = kVH.dH/dx$, where V is the volume of the substance, H the field-strength, and dH/dx the rate of change of the field-strength; k is the difference between the magnetic susceptibility of the substance and that of the surrounding medium. By determining k for the same substance in two different media, the susceptibility of the one medium can be calculated from that of the other.

An electro-magnet was placed vertically, the soft steel core being fixed at a lower level than the bobbin; in the space thus left above the core and inside the coil, balls of silver, copper, bismuth, and glass were suspended from the one pan of a balance. The mechanical force exerted on the balls when the magnet was excited was measured by the change necessary in the counterpoise. The apparent susceptibility of each ball was determined first in air and then in liquid oxygen; in the latter case, a vacuum vessel filled with liquid oxygen occupied the space above the core.

The mean value of the susceptibility of liquid oxygen is found to be 324×10^{-6}. This holds for values of H between 500 and 2500 C.G.S. units; the susceptibility increases with low values of H. From the relation $\mu = 1 + 4\pi k$, μ (the magnetic permeability of liquid oxygen) is calculated to be 1·0041. The authors previously found, by a different method, $\mu = 1·0027$; they consider the value 1·0041 much more probable.

The measurement of magnetic susceptibility at low temperatures is discussed and a method described of determining paramagnetic susceptibility. The susceptibility of manganous sulphate at 25° is to that at −180° in the ratio of 1 : 3·32, that is, inversely as the absolute temperature. Other experiments with manganous sulphate indicate that paramagnetic susceptibility varies directly as the density. On the basis of these data, the susceptibility of liquid oxygen is calculated from that of gaseous oxygen, and found to be 314×10^{-6}, a value very close to that given by experiment. Hence the very large paramagnetic susceptibility of liquid oxygen is partly due to its low temperature.

J. C. P.

Measurement of Low Temperatures. By ALBERT LADENBURG and C. KRÜGEL (*Ber.*, 1899, **32**, 1818—1822).—The author has employed Holborn and Wien's method (*Ann. Phys. Chem.* 1896, [ii], **59**, 213) in which a thermo-element is used, but has standardised the galvanometer in a special manner, namely, by determining three instead of two fixed points by the aid of the hydrogen thermometer.

With the aid of this apparatus, the following data have been obtained.

Boiling points :—

Oxygen – 181·4°, nitrogen – 142·4°, methane – 152·5°, ethane – 85·4°, ethylene – 102·65°, propylene – 50·2°, trimethylene about – 35°, acetylene – 83·8°, toluene + 110°, ethylbenzene + 135—136°, mesitylene + 164°, methylic formate + 32—33°, ethylamine + 19—20°.

Melting points :—

Nitrogen – 150·0°, ammonia – 77·05°, ethane – 171·4°, trimethylene – 126°, toluene – 94·2°, ethylbenzene – 94·2°, mesitylene about – 59·6°, cymene – 75·1°, methylic chloride – 103·6°, ethylic bromide – 116·0°, methylic alcohol – 94·9°, ethylic alcohol – 112·3°, ethylic ether – 112·6°, acetaldehyde – 120·7°, acetone – 94·9°, ethylene glycol – 17·4°, methylic formate – 101·2°, ethylic acetate – 83·8°, ethylamine – 85·2°.

J. J. S.

Gradual Change of Glass and the Variation of the Zero Point of Thermometers. By L. MARCHIS (*Zeit. physikal. Chem.*, 1899, **29**, 1—26).—The variation of the zero point of a thermometer is an example of expansion hysteresis, and is a special case of the general case of gradual change studied by Duhem (Abstr., 1897, ii, 439). If glass be heated from T_0 to T_1 the specific volume increases from V_0 to V_1, but on again cooling to T_0 the specific volume does not return to V_0 but to a volume V_2 which may be greater or less than V_0, and by repetition of the process the volume changes in the same manner but to a less extent until a final fixed value is reached. The variation of the zero point hence does not proceed with a definite velocity which is a function of the temperature to which it is heated (Young, *Nature*, 1890, **41**, 152, 271, 288), as if kept at a constant temperature the variation is far less than when subjected to numerous temperature changes below this constant temperature, and the variation is not one for which a velocity can be calculated. The author describes the apparatus by which the thermometers could be subjected to definitely varying temperatures and the differences between new thermometers and those in use were investigated; many experiments were made but few of the experimental numbers are given in the present paper. L. M. J.

Heat, Energy, and Entropy. By OTTO WIEDEBURG (*Zeit. physikal. Chem.*, 1899, **29**, 27—50).—A theoretical paper, in which the thermodynamical deductions are obtained in a manner slightly different from the one usually adopted. L. M. J.

Heat of Dissolution. By J. J. VAN LAAR (*Zeit. physikal. Chem.*, 1899, **29**, 159—161).—A reply to Noyes (this vol., ii, 401), in which the author contends that the errors in Noyes' expressions are due to a confusion of the 'integral' with the 'actual' heat of dissolution of a compound. In the thermodynamical methods originally employed by the author, this confusion cannot occur, and on this account those methods are preferable. L. M. J.

Cryoscopic Measurements. By A. Ponsot (*Bull. Soc. Chim.*, 1899, [iii], 21, 356—361. Compare Abstr., 1897, ii, 88, 363, 440; 1898, ii, 555; this vol., ii, 357).—A further criticism of Raoult's conclusions, with remarks on the sources of error attending cryoscopic measurements. N. L.

Freezing Point of Mixtures of Acetic Acid and Water. By Louis C. de Coppet (*Ann. Chim. Phys.*, 1899, [vii], 16, 275—288).—The freezing points of mixtures of acetic acid and water cannot be represented by a single curve, but are found to lie on two intersecting curves which are each capable of prolongation beyond the point of intersection; the exact limit of the extension has not been determined. When solutions containing 56 to 64 per cent. of acetic acid are cooled, three types of crystals may separate, (1) ice, which floats on the surface of the liquid; (2) glacial acetic acid which accumulates at the bottom of the experimental tube; and (3) opaque, white crystals which have approximately the same density as the mother liquor; these consist of the cryohydrate, and are only formed spontaneously when the temperature is kept below −26·75°. A solution containing 63·29 per cent. of acetic acid is placed in a freezing mixture until its temperature is −27·68°, a fragment of ice is added, the temperature gradually falls to −28·87°, and remains stationary for one minute, and during this interval ice separates; the temperature then rises rapidly to −25·42° and glacial acetic acid is precipitated, it then falls to −26·75°, and remains stationary for some time whilst the cryohydrate crystallises. However, it is not possible to bring about the separation of ice or glacial acetic acid from a solution containing 60·50 per cent. of acid; this mixture has only one freezing point, −26·75°, and the constituents always crystallise together in the form of the cryohydrate. The composition of this product is not absolutely invariable, the percentage of acid varying from 59·8 to 61·0 per cent. The temperature −26·75° is represented by the point of intersection of the two curves. One curve corresponds with the separation of ice from dilute acetic acid solutions and the other with the separation of the glacial acetic acid from its aqueous solutions. G. T. M.

Researches on the Polymerisation of Cyanogen Compounds. By Paul Lemoult (*Ann. Chim. Phys.*, 1899, [vii], 16, 338—432).—The greater part of this work has already been published (compare Abstr., 1896, i, 70, ii, 11; 1897, i, 234, ii, 87; 1898, i, 117, 402, 458). The paper includes a discussion of the results obtained and additional thermochemical data.

	Molecular heat of combustion.	Molecular heat of formation.
Dicyanodiamide, $(CN_2H_2)_2$...	328·73 Cals.	−2·23 Cals.
Cyanuramide, $(CN_2H_2)_3$ ...	468·9	21·9 „
Cyanomethine, $(CNMe)_3$ ...	845·8	30·50
Cyanoethine, $(CNEt)_3$ ...	1311·7	54·5

When polymerisation is accompanied by a change of chemical functions, it will take place even if the reaction results in only a slight development of heat. The polymerisation of a mol. of cyanamide to dicyanodiamide is accompanied by evolution of 7 Cal., and the change to cyanuramide liberates 15 Cal. Similarly, when acetonitrile and propionitrile change into cyanomethine and cyanethine respectively, about 9 Cal. are evolved. G. T. M.

Thermal Relations of Normal Butylmalonic Acid. By Gustave Massol (*Bull. Soc. Chim.*, 1899, [iii], **21**, 277—278).—The heat of solution of butylmalonic acid is $-3\cdot98$ Cal.

$C_7H_{12}O_4$ diss. + KOH, diss. = $C_7H_{11}O_4K$ diss. develops $+14\cdot53$ Cal.
$C_7H_{11}O_4K$ diss. + KOH diss. = $C_7H_{10}O_4K_2$ diss. „ $+13\cdot47$ Cal.
$C_7H_{12}O_4$ diss. + 2KOH diss. = $C_7H_{10}O_4K_2$ diss. „ $+28\cdot00$ Cal.

The heat of solution of the anhydrous potassium salt is $+5\cdot00$ Cal. Calculated for the solid acid and potash, the heat of formation is given by:

$C_7H_{12}O_4$ sol. + 2KOH sol. = $C_7H_{10}O_4K_2$ sol. + $2H_2O$ sol. $+46\cdot80$ Cal.

The heat of formation of the normal potassium salt of normal butylmalonic acid has approximately the same value as those of its contiguous homologues, the numbers for isopropylmalonic, normal butylmalonic, and normal amylmalonic acids being respectively 46·34, 46·80, and 46·69 Cal. In these three acids, the two carbonyl groups are at the same distance apart, and it is concluded that the molecular weight of the lateral hydrocarbon residue has a negligible influence on the acidimetric value of the molecule. T. H. P.

Compounds of Lithium, Sodium, and Potassium, with Mercury, as Indicated by the Specific Volumes. By E. Maey (*Zeit. physikal. Chem.*, 1899, **29**, 119—138).—In a mixture, the specific volume is a linear function of the percentage content of one of the components, thus if V_1, V_2 be the specific volumes of the components, and r the percentage of (2), then $V = V_1 + (V_2 - V_1)r$; further, if in a mixture of two compounds the percentage of (2) is r, and in the two compounds themselves the percentages are r_1, and r_2, whilst q is the percentage of the second compound in the mixture, then $r = r_1 + (r_2 - r_1)q$. It follows therefore that the specific volume of the mixture is also a linear function of r. Hence, if in the case of a mixture of mercury with an alkali metal a curve is drawn for specific volume against percentage amount of alkali metal, it should consist of a number of straight lines, intersecting at points which indicate the composition of definite compounds. In this manner, the following compounds are found to exist: $NaHg_5$, $NaHg_2$, NaHg, Na_3Hg; $LiHg_5$, $LiHg_3$, LiHg, Li_3Hg; KHg_{11} or KHg_{12}, KHg_3, KHg_2, KHg. Of these, NaHg, KHg_2, KHg, and the lithium compounds have not been hitherto observed. Many of the compounds were obtained crystalline, including a potassium compound, KHg_5, and the heats of formation of the sodium and potassium compounds were also determined. L. M. J.

Relation Between Osmotic Work and Osmotic Pressure. By Konrad Dieterici (*Zeit. physikal. Chem.*, 1899, **29**, 139—146).—A controversial paper, in which the author replies to the criticisms of

Noyes (this vol., ii, 357), and defends those views which the latter held to be erroneous. The deductions of Noyes are further considered to be inaccurate, and the corrections are given; they are, moreover, unjustifiable, being based on the assumption of a case which is incapable of experimental realisation. L. M. J.

Determination of Molecular Weights from the Dissociation Pressures of Gaseous Hydrates. By G. Rosset (*Bull. Soc. Chim.*, 1899, [iii], 21, 361).—The pressure of dissociation of a gaseous hydrate, such as chloral hydrate, in contact with an aqueous solution is much greater, and capable of more accurate measurement, than the vapour pressure of the solution itself, and a definite relation exists between the two pressures, which may be expressed by the equation $p^n\ p^{1n^1} =$ constant. It is therefore suggested that the comparison of the dissociation pressures of a suitable gaseous hydrate in contact with an aqueous solution and with pure water, would form a very sensitive method for determining the molecular weight of the dissolved substance. N. L.

Gaseous Reactions in Chemical Kinetics. I. By Max Bodenstein (*Zeit. physikal. Chem.*, 1899, **29**, 147—159).—In spite of its importance and theoretical simplicity, the dynamics of gaseous reactions has been little studied. The form of the expression connecting the velocity of a reaction with the temperature is $d.\ \log.\ k/dt = A/T^2 + B$, where B, however, may be a function of T. It is doubtful whether the velocity becomes zero at the absolute zero of temperature in all cases, although this supposition is supported by the fact that in many gas reactions the temperature coefficients are approximately equal if the reactions become measurable at approximately equal temperatures. The author proposes to examine experimentally this question by the determination of the temperature variation of the decomposition of hydrogen iodide. Most cases of chemical equilibrium are due to the equal velocities of two reverse changes, but in some cases this is not so, and a reaction is under certain conditions brought to a standstill which may be regarded as a case of 'false equilibrium.' Examples of such a case are found in the formation and decomposition of hydrogen selenide (Pélabon, Abstr., 1897, ii, 251) and in various oxidation phenomena, and the author considers these require further investigation. The results of the experimental work are deferred to later papers. L. M. J.

Demonstration of the Law of Mass Action as Applied to Weak Electrolytes. By Eugen Bamberger (*Ber.*, 1899, **32**, 1808—1809).—It is well known that the addition of potassium or ammonium acetate to solutions of acetic acid diminishes the number of hydrogen ions present; this is usually demonstrated by the fact that acetic acid to which much potassium acetate has been added does not dissolve ferrous sulphide. It may also be shown by the fact that acetic acid containing a considerable amount of an acetate in solution is no longer capable of liberating nitrous acid from a nitrite. J. J. S.

Velocity of Crystallisation. III. By Gustav Tammann (*Zeit. physikal. Chem.*, 1899, **20**, 51—76. Compare Abstr., 1898, ii, 425; this vol., ii, 272).—The author considers that the initial increase of the velocity of crystallisation with undercooling, that is, the decrease of the velocity with rise of temperature, is due to the slow conduction of heat from the surface of crystallisation. The undercooling necessary for the maximum velocity should therefore be proportional to the latent heat of fusion per unit volume, and to the velocity itself, and inversely proportional to the conductivity. The effect of heat conduction is proved by enclosing a copper cylinder in an outer glass tube, leaving an annular space of 0·1 mm., in which the crystallisation-velocity is considerably increased in those limits within which it increases with undercooling, whilst it is also greater in narrow tubes than in broad tubes. If the constant maximum velocity of crystallisation is small, then, on account of the loss of heat, it may not be actually reached, and a maximum point is obtained (this vol., ii, 206). If a tube filled with undercooled benzophenone crystallising with its maximum velocity, is placed on a bath at 70°, the crystallisation is checked, but at about $-40°$ the second modification of benzophenone forms, and on sowing the first modification in this, a cloudy mass results, containing also a third modification. If the temperature of the tube is now raised to $-30°$, the slight velocity of crystallisation of the first modification increases, and then very rapidly reaches its maximum value, but in narrower tubes, with hence better thermal conductivity, the temperature and velocity at which the sudden increase occurs is considerably raised, and numerous experiments are recorded to show this effect. The specific heat of the solid and liquid forms and the latent heat of fusion were determined for apiole, benzophenone, and betol, and the author hence calculates that for these compounds the temperature at which the velocity commences to decrease should, under adiabatic conditions, be: apiole, $-40°$; benzophenone, $-15°$; betol, $+40°$, the found values being respectively $-2°$, $+8°$, and $+60°$. These compounds, and probably all compounds, are polymorphous, and the conditions of crystallisation with the maximum velocity are determined for the three modifications of benzophenone, two modifications of apiole, three modifications of salol, and four modifications of betol. By sowing crystals of the third modifications (m. p. 25·2°) in a tube of undercooled benzophenone, a clear, crystalline mass is obtained, which by addition of the first modification changes into this compound, and owing to the cloudiness produced by the change the velocity can be measured. The curve is given for this transitive velocity, which increases to about 24°, remains constant to about 22°, and then decreases. L. M. J.

Diazotisation. By ARTHUR HANTZSCH and M. SCHÜMANN (*Ber.*, 1899, **32**, 1691—1703).—In order to study the velocity of the change represented by the equation $R\cdot NCl\colon H_3 + HNO_2 = R\cdot NCl\colon N + 2H_2O$, the nitrous acid is estimated from time to time by a colorimetric method. For this purpose, Kopp and Spiegel's diphenylamine test is unsuitable, owing to the heat which is developed on mixing the nitrous acid solution with the sulphuric acid in which the diphenylamine is dissolved; the best results are obtained by Trommsdorf's method, which depends on the development of a blue coloration in a solution of zinc iodide and starch, and can be used in $N/100,000$ solution.

The action is complete in about half an hour at 0° in *N*/100 solution, but proceeds with suitable velocity at *N*/1000, whilst at *N*/100,000 it only proceeds extremely slowly, especially in the last stages. The solutions used were therefore *N*/1000, and were diluted to *N*/100,000, in order to determine the nitrous acid. The blue coloration of the starch iodide takes some time to develop, and the comparison of tint is made from 15 to 60 minutes after adding the nitrous acid solution; for this reason, the values obtained in the initial stages of the reaction are too high, but in the later stages the error appears to be only slight.

The chief disturbing influence is caused by the formation of diazoamido-compounds. In *N*/100 solution, without any excess of acid, no separation takes place in the case of aniline, and at *N*/1000, although the solution becomes yellow after 24 hours, it still remains clear; parabrom- and paranitr-aniline, however, gave a large amount of the diazoamido-compound. The addition of 1 mol. of hydrochloric acid in excess produces a marked increase in the velocity, but no further change is produced by adding more acid. Thus aniline at *N*/1000 and 0° had changed in half an hour to the extent of 52 per cent. without any excess of acid, but 65 per cent. had changed with 1 mol. of free hydrochloric acid; on the other hand, parabromaniline at *N*/1000 and 10° had changed to the extent of 80 per cent. in half an hour, 95 per cent. in 3 hours, and 99 per cent. in 6 hours, when either 1 or 5 mols. of free hydrochloric acid were present.

In presence of an excess of acid, the velocity of change is the same for all bases; thus at *N*/1000 and 0°, aniline, paratoluidine, metaxylidine, and parabromaniline had changed to the extent of 65 per cent. in half an hour, 82 per cent. in 2 hours, and 99 per cent. in 16 hours, the variation for the separate bases being only about 1 per cent., and easily accounted for by experimental errors. When no excess of acid was used, it was found that the strongest bases changed most rapidly towards the end of the action, but no marked difference occurred in the earlier stages; the weaker bases, however, soon gave irregular results, owing to the formation of diazoamido-compounds. The increase of velocity on the addition of an excess of acid is explained by the complete conversion of the base into the form of neutral salt or ion, owing to the disappearance of hydrolytic dissociation; the reaction is regarded as taking place between the ions, $\mathrm{R\cdot\overset{+}{N}\vdots H_3 + HNO_2 = R\cdot\overset{+}{N}\vdots N + 2H_2O}$, and these are therefore the active agents in the change.

The temperature has a marked influence on the velocity; thus, parabromaniline in *N*/1000 solution, with 1 mol. of free hydrochloric acid, had changed in half an hour to the extent of 64 per cent. at 0°, 80 per cent. at 10°, and 95 per cent. at 20°.

The reaction which takes place is of the second order, and the values obtained for the velocity-constant, $C = x/(a - x)t$, were 0·036 for aniline, 0·038 for toluidine, 0·041 for metaxylidine, and 0·045 for parabromaniline in *N*/1000 solution with 1 mol. of free acid at 0°.

T. M. L.

Aminolysis. By HEINRICH GOLDSCHMIDT and RICHARD M. SALCHER (*Zeit. physikal. Chem.*, 1899, **29**, 89—118).—The strength of bases is dependent on the degree of dissociation of the hydroxyl, but in the case of organic bases dissolved in certain solvents no hydroxyl group may be present. It has been shown (Abstr., 1896, ii, 515) that diazoamido-compounds are converted into amidoazo-compounds by aniline hydrochloride in aniline or other solution, and that the reaction is monomolecular, the velocity being proportional to the concentration of the aniline hydrochloride. Hence, if to a solution of the diazoamido-compound in aniline a salt such as pyridine hydrochloride is added, the velocity is proportional to the concentration of the free acid, that is, to that of the aniline hydrochloride since the pyridine salt is undissociated, and the active mass of the aniline is constant. Hence, this concentration, which is that of the decomposed pyridine salt, may be found, and from this the equilibrium constants between the aniline and pyridine salts, or what the author terms the aminolytic constant. The velocity constants for the change from the diazo- to the amido-azo-compounds were determined for different acids, the values being—hydrochloric acid, – 0·080; hydrobromic acid, 0·140; nitric acid, 0·116; and orthonitrobenzoic acid, 0·0088; it is noticeable that the first three acids, although equally dissociated in aqueous solutions, have in this case different effects. The conversion velocity was next determined in the presence of pyridine and hydrochloric, hydrobromic, and orthonitrobenzoic acids; the aminolytic constants calculated as above were found to be 2·36, 2·32, and 2·23, so that the constant is independent of the acid employed. Various bases were then examined, and the following values for the aminolytic constant were obtained—quinoline, 1·66; pyridine, 2·32; tribenzylamine, 2·95; quinaldine, 5·31; *α*-picoline, 10·7; *s*-collidine, 287; dimethylbenzylamine, 10,500; diethylbenzylamine, 21,700; triethylamine, 434,000. The affinity constants of most of these bases have been found by Bredig, and those of the remainder were determined; it is seen that the aminolytic constants follow the same order as the affinity constants, and are approximately proportional to them, so that the base which in aqueous solution is the most highly dissociated can also remove the largest amount of acid from aniline hydrochloride in aniline solution. The exact import of this is not further discussed, but it is pointed out that it is possible that the strengths of acids may also be comparable under conditions which preclude dissociation.
L. M. J.

Recognition of Racemic Compounds. By ALBERT LADENBURG (*Ber.*, 1899, **32**, 1822—1825. Compare Trans., 1899, **75**, 466).—An exception to the generalisation previously made may occur when a diminution in the solubility of the racemic compound occurs, but is exactly counterbalanced by the amount of the dissolved optically active component. The question of racemism may then be solved by finding whether the solution is optically active or not; if it is active, then the original compound must have been racemic, if inactive, then the original was a mixture. This has been tested in several cases and found to hold good (compare Pope, Proc., 1899, **15**, 73). J. J. S.

Position of Helium, Argon, and Krypton in the Scheme of Elements. By Sir William Crookes (*Proc. Roy. Soc.*, 1898, **63**, 408—411).—The elements are arranged in the order of their atomic weights on a line which traces out a figure-of-eight spiral. Each of the successive loops is divided into eight equal parts, and an element is placed at each point of division. Analogous elements are then found to be on the same vertical. The electropositive elements are on those parts of the curve which are leaving, the electronegative elements on those parts of the curve which are approaching, the middle line of the figure. The atomicity of the elements on the loops is given by the number of places they are removed from the middle line of the figure.

The elements occupying positions on the curve between the loops might be expected to be chemically and electrically neutral, and it is pointed out that helium, argon, and krypton (with atomic weights of 4, 40, and 80 respectively) would naturally occupy these positions, and that neon and metargon would also fall on the central neutral line of the figure. J. C. P.

New Aspirator. By Arthur Rosenheim (*Ber.*, 1899, **32**, 1831—1833).—For use with a form of double aspirator similar to that devised by Fairley (Thorpe's *Dict. App. Chem.*, 1, 206), the author describes a simple automatic glass valve, which enables the four-way tap to be dispensed with, and obviates all fear of back pressure when the aspirating bottles are being interchanged.

J. J. S.

Burettes and Separating Funnels. By F. Stöber (*J. pr. Chem.*, 1899, [ii], **59**, 595—596).—When a burette with a tap or a pinchcock at the delivery end cannot be used, it is recommended to have a bent glass tube fitted with a pinchcock attached to the upper end of the burette. By opening the pinchcock, the liquid is delivered from the burette. This can be filled from the delivery end by use of a suction pump. When the burette is not in use, the delivery end is closed by a very small glass flask. A similar arrangement is suggested for separating funnels to allow of complete separation. R. H. P.

Apparatus for Heating Sealed Tubes at a Constant Temperature. By John J. Sudborough (*J. Soc. Chem. Ind.*, 1899, **18**, 16).—The apparatus has been devised for heating sealed tubes in the vapour of a liquid of high boiling point such as cumene or aniline. The tubes, which are kept in position by two copper discs, each perforated with four holes, are placed in a stout copper cylinder some 25 inches long and 6 inches in diameter, closed at one end and placed horizontally on an iron stand 9 inches high. The liquid is contained in a 150 c.c. dish, preferentially hammered out of the material of the cylinder itself, so as to avoid using rivets. On the upper side over the dish a copper tube is soldered, to which a Soxhlet's metal condenser is attached. A stout brass collar is soldered to the open end of the cylinder, which may be closed with a large brass cap screwing into the collar and fitted with a narrow strip of sheet cork.

L. de K.

Inorganic Chemistry.

High-Strength Hypochlorite Solutions. By MAX MUSPRATT and E. SHRAPNEL-SMITH (*J. Soc. Chem. Ind.*, 1899, **18**, 210. Compare this vol., ii, 281).—Solutions were prepared containing from 22—42 per cent. of available chlorine, and, after eliminating the iron, they were kept in closed earthenware bottles for seven weeks. The results, as tabulated, prove that from the point when salt begins to deposit to the point when it has practically all settled, the hypochlorite is not quite so stable as it was at lower strengths before any deposition of salt took place.

In the former experiments, a considerable amount of chlorate was formed, but owing to improved means of circulation and cooling, and to a better regulation of the amount of caustic soda, the formation of chlorate has been reduced by about 50 per cent. The authors have also succeeded in obtaining well-defined crystals of reasonably pure sodium hypochlorite. These form prisms of the quadratic system, are freely deposited from a solution containing 42 per cent. of available chlorine, and although still not pure, are much more stable than the solution from which they were formed. L. DE K.

Oxidising Action of Hydroxylamine. By L. MARINO (*Zeit. anorg. Chem.*, 1899, **20**, 452).—In reference to the work of Tanatar (this vol., ii, 285), it is pointed out that Piccini first described the action of hydroxylamine as an inorganic oxidising agent, and reserved for himself the complete investigation of the subject. This the author is now carrying out at Piccini's request. J. C. P.

Perborates. By SIMEON M. TANATAR (*Zeit. physikal. Chem.*, 1899, **29**, 162. Compare Abstr., 1898, ii, 427).—Perborates decompose gradually, for after keeping a year in corked vessels the ammonium salt was found to be considerably changed, the residue containing nitrite and nitrate; the sodium salt was also found, under similar conditions, to have lost 30 per cent. of active oxygen. This decomposition is more rapid in an atmosphere containing carbonic anhydride. The perborates are not formed by the action of chlorine on borates, and are decomposed by hypochlorites with the production of pure oxygen. A similar evolution of oxygen is brought about by the catalytic action of cobaltic oxide. They are also decomposed by the electric current, and do not appear to be formed by the action of ozonised oxygen on orthoborates. L. M. J.

Action of Ammonia and Amines on Silicon Chlorides. By FELIX LENGFELD (*Amer. Chem. J.*, 1899, **21**, 531—537).—On mixing benzene solutions of silicon tetrachloride and ammonia, the first product is *silicon tetramide*, $Si(NH_2)_4$, a white solid, which is extremely unstable, and even at ordinary temperatures loses ammonia and forms silicon di-imide, $Si(NH)_2$. The product that is usually isolated has the empirical composition $SiCl_4,6NH_3$, and yields one-third of its ammonia when thrown into water; it is therefore regarded as a compound of silicon di-imide with ammonium chloride of the composition $Si(NH)_2,4NH_4Cl$. *Silicon tetrethylamide* is a colourless oil which boils at 102° under 20 mm. pressure; it keeps indefinitely in closed tubes, is decomposed by water, although not instantly, is soluble in most organic solvents, and dissolves in dilute nitric acid without complete decomposition. T. M. L.

Ammonium Hyposulphites. By Maurice Prud'homme (*Bull. Soc. Chim.*, 1899, [iii], 21, 326—328).—When a solution of ammonium sulphite is agitated in the cold with metallic zinc, one-half of the salt is converted into the insoluble compound $ZnSO_3,2NH_3$ and the other half into normal ammonium hyposulphite. On filtering the liquid, the latter salt is obtained in solution free from zinc; the yield is 96—98 per cent. of the theoretical. The action of zinc on ammonium hydrogen sulphite (6 mols.), leads to the formation of ammonium hydrogen hyposulphite (2 mols.), normal ammonium hyposulphite (1 mol.), zinc sulphite (2 mols.), and the double salt $ZnSO_3,2NH_3$ (1 mol.). N. L.

Formation of Carbides of the Alkali and Alkaline-earth Metals and of Magnesium. By Henri Moissan (*Ann. Chim. Phys.*, 1899, [vii], 16, 145—152).—A *résumé* of work already published (Abstr., 1898, ii, 332). G. T. M.

Cement from an Ancient Water Conduit. By Friedrich Dörner (*Monatsh.*, 1899, 20, 265—271).—A light grey cement of an irregular structure taken from the small water conduit of the theatre at Ephesus contained CaO, 52·65; Al_2O_3 and Fe_2O_3, 0·27; MgO, 0·7; Na_2O, 0·5; SiO_2, 1·7, CO_2, 40·33, and H_2O, 0·98 per cent.; an ancient cement from Smyrna was found to have an almost identical composition. Both materials contained about 2·5 per cent. of organic matter, from which, by extracting with ether, evaporating, and recrystallising the residue from alcohol, a mixture melting at 62·3°, and containing about 10 parts of palmitic acid and 90 of stearic acid, was obtained. The residual dark brown liquid probably consisted of saturated and unsaturated fatty acids. The portion of the organic matter which is not extracted by ether is also insoluble in carbon bisulphide, benzene, or light petroleum, slightly soluble in water, and easily so in alkalis. From the alkaline solutions, acids precipitate dark-brown flakes. This substance seems to be a humin compound, although the amount of hydrogen (7·4 per cent.) is unusually high.

Cements made by mixing quicklime with linseed or olive oil crack, and set very slowly, but mixtures of slaked lime with these oils form good cements, the best results being obtained by using 2 parts of lime to 1 of olive oil. These ancient cements were probably made of a similar mixture, the proportion of organic matter having decreased during the long exposure, owing to decomposition and loss of all the glycerol. E. W. W.

Beryllium. By Paul Lebeau (*Ann. Chim. Phys.*, 1899, [vii], 16, 457—503).—A detailed account of work previously published in an abridged form (compare Abstr., 1896, ii, 168, 169, 187; 1897, ii, 144; 1898, ii, 292, 511, 580, 581). G. T. M.

Action of Water on Zinc and Galvanised Iron. By Herbert E. Davies (*J. Soc. Chem. Ind.*, 1899, 18, 102—105).—All kinds of water attack zinc or galvanised iron in the presence of air. Distilled or rain water has a decided solvent action, although after a time the greater part of the metal is reprecipitated. Hard waters dissolve a larger quantity, in which respect zinc differs from lead. When the metal gets gradually coated with hydrated zinc carbonate, the action is not altogether stopped, and the water may still contain 0·3 part of zinc per 100,000. It is not yet satisfactorily made out whether the continued use of water containing zinc is injurious to the system, but the metal may be detected in all the viscera. L. de K.

Reducibility of Metallic Oxides. By Henri Hélier (*Bull. Soc. Chim.*, 1899, [iii], 21, 43—44).—The chemical properties of many metallic oxides undergo marked alteration when these substances are exposed to high temperatures. These changes may be due to polymerisation of the molecule of the oxide. Litharge when heated to 350° in a current of hydrogen loses some of its oxygen, but the reduction is never complete; the carbonate, however, on similar treatment, is completely reduced at 325°. The author supposes that litharge is a polymeride of PbO, and that the simple oxide is to be found only in normal salts such as the carbonate. G. T. M.

Properties of Aluminium. By Alfred Ditte (*Ann. Chim. Phys.*, 1899, [vii], 16, 152—162).—The author's views on the alterable nature of this metal have been already quoted (compare this vol., ii, 225, 292, 425, 426). G. T. M.

A Tungsto-potassic Tungstate. By L. A. Hallopeau (*Bull. Soc. Chim.*, 1899, [iii], 21, 267—269).—After maintaining a mixture of tin and potassium paratungstate for an hour at a temperature sufficiently high to melt the tungstate, and treating the residue successively with boiling water, concentrated hydrochloric acid, a boiling 50 per cent. solution of potassium carbonate, and finally with hot water again, there remains a dark blue powder consisting of prismatic crystals of the composition $K_2O,WO_3 + WO_2,3WO_3$. T. H. P.

Double Chlorides and Bromides of Uranium. By Jules Aloy (*Bull. Soc. Chem.*, 1899, [iii], 21, 264—266).—On passing the vapour of uranium tetrachloride, prepared by the action of chlorine on uranium carbide, over potassium or lithium chloride heated to dull redness, the latter gradually melts owing to its absorption of the uranium chloride, forming a double salt, $UCl_4,2KCl$ or $UCl_4,2LiCl$; these salts are pale green when first prepared, but are very hygroscopic, and rapidly darken as they absorb moisture from the air. They are very soluble in acetic acid, and dissolve also in water with development of heat, giving a strongly acid solution which oxidises slowly in the air at ordinary temperatures, and more rapidly when heated. The solutions are decomposed by water, so that when evaporated in a vacuum over sulphuric acid, crystals of alkali chloride are deposited, and a green, uncrystallisable mass left behind. Alcohol gives a green solution which also rapidly oxidises and becomes yellow.

By similar methods, double chlorides of uranium and the alkaline earth metals can be prepared; in this case, care must be taken to dry the chloride before heating, which must not be carried too far. The compounds formed, which have the composition UCl_4,MCl_2 (where M corresponds with Ca, Sr, or Ba), are of a deeper green colour than those yielded by the alkali metals; like the latter, they are decomposed by water and cannot be obtained crystalline by evaporating their solutions in a vacuum.

The above method may be employed to prepare double bromides corresponding with the chlorides already described. The double bromides are of a deeper green colour than the chlorides, to which they are analogous in properties.

The double chlorides of uranyl and the alkali metals may be obtained by passing dry chlorine over gently heated uranous oxide, by which means uranyl chloride is formed; the latter is then led over the alkali chloride with which it combines, forming golden-yellow, fusible compounds. T. H. P.

Compounds of Titanium Dioxide with Sulphuric Acid. By Blondel (*Bull. Soc. Chim.*, 1899, [iii], **21**, 262—264).—By heating a concentrated sulphuric acid solution of titanium dioxide in a sealed tube at 120°, a mass of silky crystals is obtained which are soluble in water acidified with hydrochloric acid, and have the composition $2TiO_2,3SO_3 + 3H_2O$. On raising the temperature to 225°, the mass changes into rhomboidal crystals of the composition TiO_2,SO_3, which are slowly decomposed by water into a basic sulphate and sulphuric acid; by maintaining the solution at 225°, the whole of the titanium present can be separated in this form. Rutile readily dissolves in concentrated sulphuric acid when heated to about 200°, but if the temperature of the acid exceeds 225°, a layer of sulphate forms on the mineral, and protects it from further action.

On diluting a solution of titanium dioxide in concentrated sulphuric acid with an equal volume of water, the liquid at any temperature above 100° deposits long needles which have the composition $TiO_2,SO_3 + 2H_2O$, and are readily soluble in water. If 1 part of the dioxide be dissolved in 2 parts of concentrated sulphuric acid, and water be added to the extent of $1\frac{1}{2}$ times the weight of the solution, the liquid deposits sulphates, the composition of which varies with the temperature of deposition; those formed at 100° correspond with the formula $2TiO_2,SO_3 + Aq$, and those at 130° to $7TiO_2,2SO_3 + Aq$. Solutions of titanium dioxide in concentrated sulphuric acid, when diluted with from 2 to 10 times their weight of water and heated, deposit various sulphates at temperatures below 175°, but above this temperature the anhydrous dioxide crystallises out; if, however, the solutions be strongly diluted (with 100 to 1000 parts of water) at ordinary temperatures, the compound $5TiO_2,SO_3 + 5H_2O$ is obtained, whilst at 100° the deposit consists of the dioxide with traces of sulphuric acid which cannot be removed by washing.

When a sulphuric acid solution of the dioxide diluted with slightly ammoniacal water is allowed to evaporate in a vacuum, cubic crystals of the composition $2TiO_2,2SO_3,NH_4O + 3H_2O$ separate; these crystals, which present tetrahedral hemihedrism, are slowly decomposed by water and effloresce in the air. T. H. P.

New Soluble Antimonic Acid and its Salts. By **Jean B. Senderens** (*Bull. Soc. Chim.*, 1899, [iii], 21, 47—58).—When antimony trichloride is treated with concentrated nitric acid, a vigorous action occurs, and a clear liquid is obtained, which on dilution yields a white deposit; this substance is washed with cold water and exposed to the air for 3 months at ordinary temperatures; its composition then corresponds with the formula $Sb_2O_5,6H_2O$. The orthohydrate, $Sb_2O_5,3H_2O$, analogous to orthophosphoric acid, is obtained on drying the hexahydrate over concentrated sulphuric acid for 3 weeks; when heated to 200°, it passes into the hydrate $Sb_2O_5,2H_2O$, corresponding with pyrophosphoric acid; at 300°, the metahydrate, Sb_2O_5,H_2O, is produced; at 400°, the anhydrous oxide, Sb_2O_5, is obtained, which, when heated to redness, yields the tetroxide.

The recently precipitated hexahydrate is soluble in water to the extent of 22 grams of Sb_2O_5 per litre, but a solution of this strength gradually becomes turbid, and a precipitate appears, which increases until the amount of dissolved oxide falls to 3 grams per litre. The precipitate, when dried, has a composition corresponding with $Sb_2O_5,4H_2O$, and is probably identical with the hydrate described by Fremy, by Daubrawa, and by Beilstein and Blaese (Abstr., 1889, 1123). The author's experiments show that this hydrate is less readily dehydrated on heating than was stated by these observers, and his results agree with the more recent work of Baubigny (Abstr., 1897, [ii], 351).

A solution of the soluble acid containing 8 grams of Sb_2O_5 per litre is comparatively stable; when titrated with caustic potash solution in the presence of phenolphthalein, the quantity of alkali required for neutralisation corresponds with the formation of the salt $KHSb_2O_6$, whereas with baryta the salt $BaSb_2O_6$ is indicated. The antimonates derived from the soluble acid are obtained by adding metallic acetates to its solutions; they bear a certain resemblance to the salts prepared by Ebell (Abstr., 1890, 126).

The *nickel, cobalt, copper, cadmium,* and *mercuric* salts, when dried in air, have the general formula $R''Sb_2O_6 + 5H_2O$, and when placed over concentrated sulphuric acid they lose $3H_2O$, and have a composition corresponding with $R''Sb_2O_6 + 2H_2O$. The *calcium, manganese,* and *zinc* salts have the general formula $R''Sb_2O_6 + 6H_2O$, and when dried over sulphuric acid they correspond with $R''Sb_2O_6 + 2H_2O$. The *lead* salt, when dried in air, contains $9H_2O$, and sulphuric acid removes $7H_2O$, leaving $PbSb_2O_6 + 2H_2O$. The *ammonium* and *potassium* salts, when dried in air, contain $5H_2O$ and $7H_2O$ respectively; in the presence of sulphuric acid, they form salts of the type $R_2Sb_2O_6 + 2H_2O$. All these salts, when heated to 300°, lose the remaining water.

G. T. M.

Antimony Pentasulphide. II. By **Otto Klenker** (*J. pr. Chem.*, 1899, [ii], **59**, 353—433. Compare this vol., ii, 490, and Bosek, Trans., 1895, 520).—It is shown that antimony pentasulphide, on account of the ease with which it undergoes decomposition, is not a suitable compound on which to base quantitative estimations of antimony.

The precipitate obtained on passing a stream of hydrogen sulphide into a moderately strong alkaline solution of a quinquevalent compound of antimony consists of a mixture of antimony trisulphide and sulphur (pure antimony trisulphide remaining on extraction with carbon bisulphide). Neutral or acid solutions give a precipitate composed of a mixture of the two sulphides and free sulphur, the largest proportion of pentasulphide being formed from a solution containing 12 per cent. of free hydrochloric acid. As the quantity of free acid further increases, the proportion of pentasulphide formed decreases until from a solution containing 27 per cent. of free hydrochloric acid, antimony is not precipitated. On acidifying a solution of Schlippe's salt, the precipitate obtained consists of a mixture of trisulphide and sulphur, with varying proportions of pentasulphide.

The precipitate obtained from a warm (about 75°) acid solution has the composition $Sb_2S_3 + 2S$. On the other hand, antimony pentasulphide is not affected by treatment with organic solvents boiling below 100°. R. H. P.

Colloidal Metals: Colloidal Bismuth and Copper. By ALFRED LOTTERMOSER (*J. pr. Chem.*, 1899, [ii], **59**, 489—493. Compare Vanino and Treubert, this vol., ii, 428).—When bismuth nitrate (2 mols.) is dissolved in water containing a little nitric acid, and a solution of ammonium citrate is added until the resulting precipitate dissolves, the solution made alkaline with ammonia, added to a solution of stannous chloride (3 mols.) prepared in a similar manner, and the mixture quickly heated, colloidal bismuth is deposited in the form of a very fine, black precipitate. This will dissolve in water, but is reprecipitated on addition of a solution of any salt, or of an acid. It is transformed into the insoluble form of the metal by continued boiling of its solution, or by a large excess of stannous salts.

Similarly, if alkaline solutions of cupric and stannous chlorides are warmed with a solution of sodium citrate, a precipitate is obtained consisting of a mixture of colloidal copper and colloidal stannic acid.
R. H. P.

Ruthenium and its Compounds. By UBALDO ANTONY and ADOLFO LUCCHESI (*Gazzetta*, 1899, **29**, ii, 312—318).—By fusing ruthenium with potassium hydroxide and gradually adding small quantities of nitre until the ruthenium is all dissolved, a green mass is formed, which changes to an orange colour on cooling; on repeatedly treating this mass with concentrated hydrochloric acid, a product is obtained containing more and more potassium ruthenochloride, which has, however, not been obtained in the pure state.

By dissolving barium ruthenate in fuming hydrochloric acid, and repeatedly evaporating to dryness with the acid, a residue is obtained which dissolves in water; after removing the barium by adding an excess of sulphuric acid and evaporating the solution, a dense, pale red liquid is obtained, probably containing ruthenium sulphate, which could not, however, be obtained crystalline.

When hydrogen sulphide acts in the cold on Joly's potassium chloronitrosoruthenate (Abstr., 1889, 352), partial precipitation of a ruthenium sulphide occurs, and the liquid assumes an intense azure tint. When separated from the precipitate, this liquid is quickly decolorised, even in the dark, and deposits a sulphur compound of ruthenium; if, however, the hydrogen sulphide is removed by passing a rapid current of carbonic anhydride through the liquid, the latter remains unchanged for a long time. By acting on a solution of the potassium chloronitrosoruthenate with sulphurous anhydride, the liquid changes from red to dark green, and finally to violet, and on evaporation deposits a blue powder, which may be purified by precipitating its aqueous solution with alcohol, and separated from alkali chloride by washing with dilute alcohol. This powder behaves like a colloidal substance, and has not been obtained crystalline; it is stable at about 220°, but above that temperature loses sulphurous anhydride and becomes black. T. H. P.

Composition of Osmiamates. By L. Brizard (*Bull. Soc. Chim.*, 1899, [iii], 21, 170—172).—The author confirms the compositions for these compounds previously arrived at by Joly (Abstr., 1891, 1433), namely, $KOsNO_3$, NH_4OsNO_3, and $AgOsNO_3$. The osmium was estimated by precipitation as sulphide, and subsequent reduction to the metal. J. J. S.

Mineralogical Chemistry.

Artificial Production of Diamond in Silicates. By I. Friedländer (*Geol. Mag.*, 1898, 5, 226, and *Jahrb. f. Min.*, 1899, i, Ref. 202, from *Verh. d. Ver. z. Beförd. d. Gewerbefleisses, Berlin*, Feb., 1898).—A small piece of olivine was fused in the gas-blowpipe, and the molten mass stirred with a rod of graphite; after cooling, the silicate was found to contain vast numbers of microscopic (0·001 mm.), brown crystals, but only in the parts which had been in contact with the carbon. These crystals were identified as diamond, since they are octahedral or tetrahedral in form, are unattacked by hydrofluoric and sulphuric acids, have a high refractive index, sink slowly in methylenic iodide, burn away when heated in oxygen, and are unaltered if heated in a current of carbonic anhydride; the stony matter containing them scratches corundum. This suggests that the diamonds of South Africa may have been formed by the action of a molten silicate on graphite or carbonaceous shales, such as those which are penetrated by the olivine-bearing rock of Kimberley. L. J. S.

Laboratory Production of Asphalts from Animal and Vegetable Materials. By William C. Day (*Amer. Chem. J.*, 1899, 21, 478—499).—By distilling together fat pine wood and fresh herrings from the Delaware river, from an iron retort, and passing the vapours through a red-hot iron tube, there was produced water and an oil of sp. gr. 0·9837 containing 84·28 per cent. of carbon and 10 per cent. of hydrogen. After distilling the oil up to a temperature of about 425°, a residue was left in the retort, which solidified to a black, shining mass, showing conchoidal fracture, brittle, and pulverising to a brownish-coloured powder slightly darker than the powder of the natural asphalt 'gilsonite' from Utah, which it closely resembled. The analysis of the two materials gave the following figures:

	C.	H.	N.	S.	O.	Ash.
Artificial.....	86·56	7·06	1·91	0·08	4·39	—
Natural......	85·83	10·59	2·59	0·26	0·63	0·10

The solubilities were as follows:

	Natural.	Artificial.	
Carbon bisulphide	99·50	(1) 100·00	per cent.
		(2) 81·44	„
Turpentine	97·34	49·48	„
Ether	73·08	67·03	„
Light petroleum..............	63·08	46·70	„
Alcohol	34·81	48·40	„

Both substances are similarly acted on by nitric acid, which completely dissolves the material, with copious evolution of brown fumes, and the production of a dark red solution which, when diluted with water, yields a flocculent precipitate much resembling freshly precipitated ferric hydroxide. Both substances yield solid, volatile bases when extracted with dilute sulphuric acid.

On distilling fish alone, an emulsion was obtained which was separated by warming into water and a yellow oil. On boiling down the oil in an iron crucible, a black, elastic solid was produced, which could be easily cut but not pulverised, although, when struck with a hammer, it would break with a conchoidal fracture.

The analysis (C = 76·51 and 77·36; H = 9·08 and 9·12; N = 4·19 and 4·27; S = 0·19) is somewhat similar to that of the natural asphalt elaterite from Utah (C = 73·11 and 73·88; H = 9·46 and 9·45), which it somewhat resembles. The percentage solubilities were carbon bisulphide, 68·19; turpentine, 47·36; ether, 59·17; light petroleum, 35·19; absolute alcohol, 51·07. Much ammonia was produced during the distillation, and basic nitrogen compounds could be extracted from the solid by means of dilute suphuric acid.

The distillation of pine wood gave water and an oil of sp. gr. 0·992. After distilling off more than half the oil, the residue solidified to a black, shining mass, very brittle, and showing a conchoidal fracture; the sp. gr. was 1·0825. The analysis (C = 86·20; H = 8·28; N = 0·29; O = 5·23; S, trace) resembles that of Utah nigrite (C = 83·33; H = 8·69; S = 0·42; Ash = 0·12). The percentage solubilities were, carbon bisulphide, 99·26; turpentine, 96·29; ether, 96·13; light petroleum, 90·12; absolute alcohol, 61·60. The material did not yield any basic substances when extracted with sulphuric acid.

When wood and fish are distilled together, the amount of oil produced is less, and the amount of water is greater, than when they are distilled separately; this is due to the fact that the oxygenated compounds from the fish are largely reduced by the hydrocarbons from the wood during the passage through the red-hot tube, thus affording a method of preparing an asphalt containing a moderate percentage of nitrogen, but a low percentage of oxygen.

The paper contains a discussion as to the origin of natural asphalts and bitumens. T. M. L.

Bismuthiferous Molybdenite. By LÉOPOLD MICHEL (*Bull. Soc. franç. Min.*, 1899, **22**, 29—30).—Large, steel-grey, crystalline plates with a bright metallic lustre gave, on analysis,

Mo.	Bi.	Fe.	S.	Total.
40·10	28·37	trace	30·74	99·21

At first sight, the mineral is apparently homogeneous, but when the cleavage plates are examined under a lens they are seen to enclose much bismuthite, so that the material is really an intimate mixture of molybdenite and bismuthite. L. J. S.

Colouring Substances contained in Amethyst, Citrine and Burnt Amethyst. By ARNOLD NABL (*Monatsh.*, 1899, **20**, 272—281).—When amethyst is strongly heated, its colour changes to yellow and the absorption spectrum of the calcined stone, like that of citrine, closely resembles the spectrum of ferric oxide or of a ferric compound. The absorption spectrum of amethyst is almost identical with that of a solution of ferric thiocyanate in ether, and the colouring matter of amethyst, moreover, resembles this compound in becoming yellow when heated at 180° and regaining its original colour after a time when cold. Two specimens of amethyst were found to contain respectively 0·52 and 0·53 per cent. of sulphur, although the amount of carbon, according to Heintz (*Ann. Phys. Chem.*, **60**, 519), is 0·0027 per cent., which would only correspond with 0·0072 of sulphur on the thiocyanate hypothesis. The manner of occurrence of amethyst and of citrine is also in accordance with the presence of ferric thiocyanate in the former and its change into the latter by heat, for citrine is generally found in crystalline fragments and but rarely in crystals; these crystals have, however, the same properties and form as amethyst. E. W. W.

Corundum from the Appalachians. By J. VOLNEY LEWIS (*Trans. Amer. Inst. Mining Eng.*, 1896, **25**, 852—906).—A general account is given of the occurrence of corundum in the Appalachian crystalline belt. In the descriptions of the rocks, the following mineral analyses are given:

I.—Enstatite from the enstatite-rock at Corundum Hill, Macon Co., N. Carolina. The partial alteration of the enstatite to talc accounts for the presence of water. Analysis I by C. Baskerville.

II.—Bright, grass-green hornblende, sp. gr. 3·075, which with some anorthite forms amphibolite at Buck Creek, Clay Co., N. Carolina. Under the microscope, it is seen to enclose grains of chrome-spinel. On account of the grass-green colour, this hornblende has often been called smaragdite, but it contains much more alumina than the original smaragdite.

	SiO_2.	Al_2O_3.	Cr_2O_3.	FeO.	MgO.	MnO.	CaO.	Na_2O.	K_2O.	H_2O.	Total.
I.	51·64	0·12	—	9·28	31·93	0·56	0·45	—	—	5·45	99·43
II.	44·38	17·32	0·38	3·83	15·48	0·90	11·51	1·24	0·38	4·63	100·05

L. J. S.

Artificial Cassiterite. By J. H. L. Vogt (*Zeit.-Kryst. Min.*, 1899, 31, 279—280. Compare Abstr., 1896, ii, 307).—The crevices in the hearth of a furnace used for the oxidation of metallic tin to pulverulent tin oxide were found to contain crystals of cassiterite, both simple and twinned, and up to 1 cm. long. Since salt, fluor spar, &c., were not present, the crystals have been formed by the direct oxidation of the tin without the presence of so-called "agents minéralisateurs." The usual occurrence of minerals containing boron and fluorine with tin-stone suggests that, in most cases, the natural mineral has been formed by sublimation, as in the synthetical methods of Daubrée and others. L. J. S.

Monazite from Finland. By Wilhelm Ramsay and A. Zilliacus (*Zeit. Kryst. Min.*, 1899, 31, 317—318; from *Öfvers. Finska Vet.-Soc., Förhandl.*, 1897, 39).—The pegmatite veins in the parishes of Sordavala and Impilaks on the northern shore of Lake Ladoga, contain monazite and other minerals rich in rare earths. A crystallographic description is given of the monazite. The indices of refraction for yellow light are, $\alpha = 1·7863$, $\beta = 1·7879$, $\gamma = 1·8372$; $2V = 12° 30'$; the optic axial plane is perpendicular to $b(010)$ and $Bx_a \wedge c'$ about $= +4°$. Analysis I is of fresh, transparent, yellow monazite, sp. gr. 5·163; II is of reddish-brown, decomposed monazite, sp. gr. = 4·88.

	P_2O_5.	SiO_2.	SnO_2.	ThO_2.	Ce_2O_3.	$(Di,La)_2O_3$.	Y_2O_3.	Fe_2O_3.	CaO.	Loss on ignition.	Total.
I.	26·81	1·22	0·84	5·65	31·63	29·68	2·86	0·68	0·39	0·40	100·16
II.	21·50	3·62	—	9·50	53·31		3·22	—	—	2·76	—

L. J. S.

New Minerals from Chili. By Andreas Arzruni, Konstantin Thaddéeff, and A. Dannenberg (*Zeit. Kryst. Min.*, 1899, 31, 229—247).—These notes on various minerals, by the late A. Arzruni, are completed and edited by A. Dannenberg, who gives the new name arzrunite; the chemical portion is by K. Thaddéeff.

Arzrunite.—This forms a drusy, crystalline crust, of a bright blue-green colour, in the cavities of a quartzose veinstone from Mina Buena Esperanza, Challacollo, prov. Tarapaca, Chili. The small crystals are hexagonal prisms with a prism angle of 60°, but the optical characters show them to be orthorhombic; $a:b:c = 0·5773:1:0·4163$. Analyses I and II are on material from different specimens; the second was more greenish than blue. After deducting quartz, limonite, gypsum, and epsomite (lanarkite, $PbSO_4,PbO$, was also present), the formula is given as $PbSO_4,PbO + 3(CuCl_2,H_2O) + Cu(OH)_2$. Associated with the arzrunite are small, colourless crystals, with the angles of daviesite.

Stelznerite.—This new mineral occurs at Remolinos, Vallinar, Chili, as fine, green, transparent, prismatic crystals, resembling brochantite in appearance. The system is orthorhombic; [$a:b:c = 0·50368:1:0·70585$]. The optic axial plane is $c(001)$. Sp. gr. 3·884. Analyses III and IV (IV by Schröcker) agree with the formula $CuSO_4,2Cu(OH)_2$. No water is lost at 160—170°.

Rafaelite.—Translucent, violet-red needles, with zonal bands of colour, form a crystalline crust on galena, quartz, and celestite, with schwartzembergite and arzrunite, from Mina San Rafael, Sierra Gorda, Chili. Goniometrical and optical measurements are given, and qualitative tests showed it to be an oxychloride of lead. [This is identical with paralaurionite (this vol., ii, 433. See *Nature*, 1899, 60, 238)].

Utahite.—This mineral, previously only known as minute scales from Utah, is now described from Mina Santa Rosa, Guanaco, Taltal, Chili, as small, thick, rhombohedral crystals; $cr = 52° 49'$. The crystals are dark yellowish-brown, with zonal bands of colour; they exhibit anomalous biaxial optic figures. Anal. V gives the formula $Fe_2O_3,SO_3,2H_2O$, whilst Damour's analysis of the material from Utah gave $3FeO_3,3SO_3,4H_2O$, and showed the presence of some arsenic.

Brochantite.—Analysis VI, of material from Mina Monte Cristo, Paposa, Chili, agrees with the usual formula, $CuSO_4,3Cu(OH)_2$.

	SO_3.	Cl.	PbO.	CuO.	Fe_2O_3.	CaO.	ZnO.	H_2O.	Insol.	Total.
I.	8·07	14·39	31·41	21·39	0·70	1·70	n.d.	—	13·60	—
II.	13·06	9·46	33·38	14·54	1·81	1·87	4·08	11·01	8·88	98·09
III.	22·40	—	—	67·08	0·34	0·06	—	10·22	0·44	100·54
IV.	22·19	—	—	64·01	1·14	0·57	—	10·70	1·42	100·03
V.	26·83	—	—	—	58·51	—	—	[12·47]	2·19	100·00
VI.	17·37	—	—	68·82	2·07	0·05	—	11·51	0·23	100·05

A new *Bismuth basic Carbonate.*—This forms a pale yellow botryoidal coating of small, spherical, crystalline aggregates on quartz, from Schneeberg, Saxony. Microscopical examination seems to show that the mineral is tetragonal. Analysis gave:

Bi_2O_3.	CaO.	Fe_2O_3.	CO_2.	H_2O.	Insol.	Total.
81·90	3·20	1·50	4·10	0·90	8·33	99·93

After deducting quartz, calcite, and limonite, this gives the formula $5Bi_2O_3,H_2O,CO_2$. The variations in composition of massive, earthy bismuthite may be perhaps explained by the mixing of Bi_2O_3,H_2O,CO_2 and Bi_2O_3.

L. J. S.

Hydrated Sodium Silico-aluminate. By Charles Friedel (*Bull. Soc. franç. Min.*, 1899, 22, 17—18).—A new analysis of the hydrated sodium silico-aluminate, prepared by Georges Friedel (Abstr., 1896, ii, 482) by the action of caustic soda solution on muscovite at a high temperature, gave:

SiO_2.	Al_2O_3.	Na_2O.	K_2O.	H_2O.	Total.
38·98	32·95	19·09	3·19	5·80	100·01

This gives the simpler formula, $2SiO_2,Al_2O_3,Na_2O,H_2O$. It approaches to thomsonite in composition.

L. J. S.

Sodium Silico-aluminate. By **Georges Friedel** (*Bull. Soc. franç. Min.*, 1899, **22**, 20—25).—The substance described was produced together with nepheline and the orthorhombic hydrated sodium silico-aluminate (see preceding abstract) by the action of 9 per cent. soda solution on muscovite at a temperature of 508—510°; it was only once produced, and other attempts failed. The colourless, regular octahedra are shown by the optical examination to be pseudo-cubic, and to be built up of 24 monoclinic individuals. Analyses correspond with the formula $8SiO_2,3Al_2O_3,6Na_2O$. Sp. gr. 2·660. L. J. S.

[Mineral Analyses.] By **L. G. Eakins** (*Zeit. Kryst. Min.*, 1899, **31**, 287—288; from 17*th Ann. Rept. U.S. Geol. Survey*, 1896, pt. II, 278, 451, 454).—The following analyses of Colorado minerals are given in geological papers by Whitman Cross (pp. 269—403) and S. F. Emmons (pp. 411—472).

I. A complicated intergrowth of augite and hornblende in gneiss from the Silver Cliff district. Cross considers the intergrowth to be original and not paramorphic.

II. Psilomelane on rhyolite from Silver Cliff: it contained also ZnO, 2·80; Sb_2O_3, 0·12, and traces of Co, Sr, Li.

III. Kaolinite derived from the rhyolite at Silver Cliff; it contained also CaO, MgO, and alkalis.

	SiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	MnO.	MnO_2.	CaO.	MgO.	K_2O.	Na_2O.	H_2O.	Total.
I.	48·72	9·27	3·77	6·34	0·34	—	16·79	14·67	—	0·19	0·18	100·27
II.	2·30	1·81	0·34	—	5·71	76·18	0·83	0·29	3·46	0·81	5·35	100·00
III.	68·16	17·68	—	—	—	—	—	—	—	—	12·76	98·60

L. J. S.

[Cummingtonite from Brazil.] By **Eugen Hussak** (*Zeit. prakt. Geol.*, 1898, 353).—In a paper (pp. 345—357) on the rocks and minerals of the gold-bearing quartz and pyrites deposits of Passagem in Minas Geraes, the following description is given of cummingtonite. With granular quartz and some pyrrhotite and a green spinel, it forms a cummingtonite-schist which carries some gold. It is straw-yellow to light brown and asbestiform, and resembles anthophyllite in appearance; sp. gr. 3·2; angle of optical extinction on the plane of symmetry, 12°. Analysis gave,

SiO_2.	Fe_2O_3+MnO.	MgO.	CaO, Al_2O_3, Alkalis, Loss on ignition.	Total.
[53·81]	36·29	9·90	traces	100·00

L. J. S.

[Mineral Analyses.] By **William F. Hillebrand** (*Zeit. Kryst. Min.*, 1899, **31**, 286; from 16*th Ann. Rept. U.S. Geol. Survey*, 1895, Pt. II, 123, 127).—The following analyses of minerals are given in a paper (pp. 1—209) by Whitman Cross and R. A. F. Penrose on the geology and mining industries of the Cripple Creek district, Colorado.

Soft, light-green chloropal from the Ida May mine gave the results under I. Red jasper in the ore-veins of the Victor mine gave II; it contained also traces of BaO, MgO, Li_2O.

	SiO_2.	TiO_2.	Al_2O_3.	P_2O_5.	Fe_2O_3.	CaO.	K_2O.	Na_2O.	H_2O.	Total.
I.	41·80	—	—	trace	37·20	1·10	—	—	19·90	100·00
II.	72·46	2·52			17·88	0·14	1·08	0·06	5·70	99·84

L. J. S.

Rocks and Laterite from the Seychelles. By **Max Bauer** (*Jahrb. f. Min.*, 1898, ii, 163—219).—The Seychelles are one of the few groups of small oceanic islands consisting mainly of plutonic rocks. Granite and some syenite are penetrated by dykes of felspar-porphyry, hornblende-vogesite, diorite, and diabase; and sedimentary rocks are represented by baked shales at the granite contacts. A detailed petrographical description is given of these rocks.

Opal sinter derived from the syenite gave analysis I; it is optically isotropic. Anal. II is of an adinole or hornfels in contact with the granite. Analyses I—IV, by C. Busz.

	SiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	CaO.	K_2O.	Na_2O.	H_2O.	Total.
I.	88·65	1·04	1·50	—	trace	—	—	8·36	99·55
II.	75·76	13·95	—	1·23	trace	4·15	5·36	0·50	100·95
III.	52·06	29·46	4·64	—	trace	—	—	14·40	100·59
IV.	3·88	49·89	20·11	—	—	—	—	25·98	99·86

Laterite is of wide distribution and is several metres thick; it has been formed *in situ* from the various rocks, and granite-laterite (anal. III), and diorite-laterite (anal. IV) are distinguished. It is reddish-brown, incoherent, and sandy. Thin sections under the microscope show the structure of the original rock; the quartz grains are unaltered, whilst the felspar, hornblende, and mica are altered to a colourless, scaly aggregate of minute birefringent plates; iron hydroxides fill cavities and are present as colouring matter. Analyses III and IV were made on material dried at 115°. The aluminium and iron hydroxides are dissolved out by boiling hydrochloric acid, leaving a residue of sandy quartz. The material is, therefore, not a silicate as formerly supposed. Deducting the silica as quartz and the iron as limonite, the aluminium hydroxide corresponds approximately with hydrargillite ($Al_2O_3,3H_2O$), with perhaps some admixed diaspore (Al_2O_3,H_2O), this representing the fine, scaly material pseudomorphous after the felspar, &c.

Laterite and bauxite are compared; they are practically the same in chemical composition and microscopical characters, and are the result of the leaching out of silica and alkalis with the retention of the structure of the original rock. It is suggested that bauxite has been formed in the hotter climates of the Tertiary epoch. L. J. S.

Dykes containing Huronite. By **Alfred E. Barlow** (*Zeit. Kryst. Min.*, 1899, **31**, 293; from *Ottawa Naturalist*, 1895, **9**, 25—47).—An examination of dyke-rocks from various parts of Canada, shows that huronite is of fairly wide distribution. Thin sections show that the mineral is a basic plagioclase more or less altered to saussurite. Analysis by B. J. Harrington of the least altered of the phenocrysts of plagioclase, sp. gr. 2·679, in diabase from the Nipissing district, Ontario, gave,

SiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	MnO.	CaO.	MgO.	Na_2O.	K_2O.	Loss on ignition.	Total.
54·19	28·42	0·77	0·41	trace	10·47	0·52	4·47	0·63	0·59	100·47

L. J. S.

Oligoclase from Victoria. By Alfred W. Howitt (*Rept. Australian Assoc. Adv. Sci.*, 1898, 7, 375—377).—Rounded crystals of felspar collected from volcanic detritus at Mount Anakies, in Victoria, gave the following results on analysis by F. E. A. Stone, and the corresponding angles of optical extinction are *c*(001) and *b*(010). The material is therefore oligoclase, Ab_5An.

								Extinction on	
	SiO_2.	Al_2O_3 $(+Fe_2O_3)$.	CaO.	MgO.	Na_2O.	K_2O.	Total.	*c.*	*b.*
I.	62·98	21·88	2·78	trace	5·00	1·90	94·54	+3° 7′	+12° 30
II.	62·22	22·42	3·34	trace	6·14	2·30	96·42	+3 3	+12 19

L. J. S.

Meteorite from Meuselbach, Thuringia. By Gottlob E. Linck (*Ann. k.k. naturhist. Hofmus., Wien*, 1898, **13**, 103—114).—This stone was seen to fall at Meuselbach, near Amt-Gehren, on May 19th, 1897; it weighs 870 grams; sp. gr. 3·47. It is light grey in colour, and finely granular, with white and greenish grains and chondrules. Nickel-iron, troilite and chromite are of irregular distribution. The 7·89 per cent. of nickel-iron has the following composition, agreeing with kamacite, $(NiCo)Fe_6$.

Fe.	Ni.	Co.	Cu.	Total.
85·04	13·61	1·35	trace	100·0

The portion (53·62 per cent.) of the stony matter soluble in aqua regia gave analysis I, corresponding with olivine, $(Fe_2Mg_5)_2SiO_4$, and the insoluble portion (38·49 per cent.) gave the results under II corresponding with bronzite, $(FeMg_4)SiO_3$. A bulk analysis made on another portion of the meteorite gave III; also nickel-iron 7·78.

	SiO_2.	Al_2O_3.	FeO.	MgO.	CaO.	Na_2O.	K_2O.	FeS.	Chromite.	Total.
I.	32·07	0·24	22·27	30·06	0·52	0·32	trace	14·52	—	100·00
II.	52·33	7·21	11·01	21·87	3·75	3·45	trace	—	0·88	100·50
			$FeO + Fe_2O_3$.							
III.	40·23	2·85	15·82	24·98	2·44	1·58	trace	5·76	0·35	101·79

Under the microscope, the following (in order of predominance) were seen: Olivine, bronzite, nickel-iron, troilite, colourless glass, chromite, brownish glass, and an undetermined cubic mineral. The order of formation is: Chromite, olivine and bronzite, nickel-iron, troilite, cubic mineral, colourless glass. The structure of the stone is hypidiomorphic-granular, and suggests that the minerals are primary, and that they have solidified from fusion, rather than that they are of secondary clastic origin. L. J. S.

Composition of the Water from Wells on the Sea Coast. By P. Guichard (*Bull. Soc. Chim.*, 1899, [iii], **21**, 79—81).—Analyses of well water have shown that there is very little relationship between this water and that of neighbouring rivers. The water level of the wells in the neighbourhood of the estuary of the Somme rises and falls with that of the sea, although the small amount of chloride present in the well water shows that there is no direct communication between the wells and the sea. G. T. M.

Physiological Chemistry.

Diastatic Action of Pancreatic Juice.—By **Benjamin K. Rachford** (*Amer. J. Physiol.*, 1899, 2, 483—495).—A very small quantity of hydrochloric acid has little or no retarding influence on the diastatic action of pancreatic juice, although larger quantities materially retard it. Acid proteids increase the activity. Sodium carbonate is very destructive; bile slightly helps the action and neutralises the retarding influence of hydrochloric acid and of sodium carbonate. Bile itself has some diastatic power. W. D. H.

The First Product of the Gastric Digestion of Casein. By **Ernst Salkowski** (*Zeit. physiol. Chem.*, 1899, **27**, 297—302). Under favourable circumstances, casein is wholly digested by gastric juice; under unfavourable circumstances (too low a temperature, or too little digestive fluid), there is a residue of paranuclein. Before this, however, there is a primary stage in which the casein is converted into a proteose which contains all the phosphorus of the original proteid. Casein and caseinogen are in this respect alike.

W. D. H.

Formation of Scatoleacetic Acid during the Putrefaction of Proteid. By **Ernst Salkowski** (*Zeit. physiol. Chem.*, 1899, **27**, 302—305).—Scatoleacetic acid is not exclusively a product of the activity of anærobic organisms, but is found in other cases associated with scatolecarboxylic acid. W. D. H.

Coagulation of Proteid by Electricity. By **W. B. Hardy** (*J. Physiol.*, 1899, **24**, 288—304).—Under the influence of a constant current, the particles of proteid in a boiled solution of egg-white move with the negative stream if the reaction of the fluid is alkaline, with the positive stream if the reaction is acid. The particles under the directive action of the current aggregate to form a coagulum. The action of the current is explained on the lines of Quincke's theory of electric endosmose. W. D. H.

Heat Rigor in Cold-blooded Animals. By **Horace M. Vernon** (*J. Physiol.*, 1899, **24**, 239—287).—The results obtained are mainly confirmatory of those of Brodie and Richardson, who showed that the successive shortenings that a muscle undergoes when it is gradually heated occur at the coagulation temperatures of the various proteids in muscle described by Halliburton, and later by von Fürth.

W. D. H.

Quantitative Relations of Protagon to the Medulla of Nerves. By ALFRED NOLL (*Zeit. physiol. Chem.*, 1899, **27**, 370—398).—Analyses of protagon from ox-brain give numbers which do not differ markedly from those of previous workers. The amount of protagon in the normal white matter of the brain (ox, dog, cow, man) varies from 19·4 to 21·8 per cent. of dry substance; in the white matter of the cord, from 22 to 25 per cent.; in nerves, from 7 to 12 per cent.; in grey matter, from 1·2 to 4·8 per cent. After Wallerian degeneration in nerves, the amount of protagon diminishes. This confirms what has been previously shown to occur by Mott, Barratt, and Halliburton in degenerative processes in the central nervous system. W. D. H.

A Comparison of the Ash of the Young Animal and that of the Milk. By EMIL ABDERHALDEN (*Zeit. physiol. Chem.*, 1899, **27**, 356—367, 408—462).—The result of the analysis of the ash of newborn guinea-pigs, and of their milk, bears out what Bunge has already shown to be the case in other animals, namely, the close correspondence between the two.

The second paper is a continuation of a previous research (this vol., ii, 232), it being now extended to include other animals. Analytical details are throughout given in full. W. D. H.

Estimation of Urinary Indican. By JACOB BOUMA (*Zeit. physiol. Chem.*, 1899, **27**, 348—355).—By Wang's method (this vol., ii, 458), the amount of indican in normal urine is found to be 5 milligrams a day; in pathological urines, this may rise to 18 milligrams.

By Obermayer's method (*ibid.*), the amount comes out 20 per cent. less. This is shown to be due to the fact that washing with 45 per cent. alcohol partly dissolves the indigo. W. D. H.

Hæmatoporphyrinuria. By EBERHARD NEBELTHAU (*Zeit. physiol. Chem.*, 1899, **27**, 324—334).—A case of hæmatoporphyrinuria is described. The pigment is precipitated by acetic acid, and 1130 c.c. of urine were found to contain 0·04 gram of it; the urine also contained excess of urobilin. W. D. H.

Chemistry of Malignant Tumours. By EUGEN PETRY (*Zeit. physiol. Chem.*, 1899, **27**, 398—407).—Extracts of cancerous tumours were made with 0·6 per cent. solution of sodium chloride, then with cold water, and finally with dilute alkali. From these extracts, the total proteid was estimated; albumin, globulin, and nucleo-proteid were found. There is increase of nucleo-proteid as compared with normal tissues. In a sarcoma, there was very little nucleo-proteid. There is, in these tumours, a considerable amount of proteid which is not coagulable by heat. By auto-digestion at the room temperature, this albumose-like proteid increases in quantity. W. D. H.

Analysis of the Pulmonary Ossifications of "Entèque." By CH. PORCHER (*Bull. Soc. Chim.*, 1899, [iii], **21**, 248—250).—Animals which have succumbed to the disease known as "entèque" in the Argentine Republic have a characteristic ossification of their pulmonary tissue. This ossified material consists of a number of dense, hard spines, the composition of which is practically the same as that of ordinary compact bone. J. J. S.

Inflammation Caused by the Vapours of Nitrogen Chloride. By W. HENTSCHEL (*Ber.*, 1899, 32, 1878).—The author states that violent inflammation of the mucous membrane of the throat is caused by inhaling the fumes of solutions of nitrogen trichloride; although, at first, apparently not harmful, these give rise after some months to very pronounced ill effects. W. A. D.

Physiological Action of Extracts of Sympathetic Ganglia. By ALLEN CLEGHORN (*Amer. J. Physiol.*, 1899, 2, 471—482).—From considerations as to the similarity of structure between sympathetic ganglia and suprarenal medulla, the effect of injecting glycerol and aqueous extracts of the ganglia into the circulation of animals was investigated. These extracts produce a fall of blood pressure which can be counteracted by suprarenal extract. The lowering of blood pressure is produced by the action of the extract on the neuro-muscular mechanism of the blood-vessels; the tonus of the heart muscle is lowered, the latent period and relaxation period of skeletal muscle are lengthened; there is no action on the pupil. Extracts of brain, cord, spinal ganglia, and nerves produce no fall of blood pressure. W. D. H.

Chemistry of Vegetable Physiology and Agriculture.

Laboratory Sterilising Apparatus. By JEAN HAUSSER (*Bull. Soc. Chim.*, 1899, [iii], 21, 250—253).—The apparatus consists of a porcelain funnel with a perforated plate, and fitted into the mouth of a kind of separating funnel, which, in its turn, fits into the mouth of a flask connected with a filter pump; all parts of the apparatus are heated to 125°; boiling water and kieselgühr are run on to a double layer of filter paper placed on the plate of the funnel, and in this way a layer of moist kieselgühr, 0·5—1 mm. thick, is deposited, which may be employed for sterilising purposes. According to the author, a layer of the kieselgühr, which does not allow the passage of air under a pressure of 1 kilo., acts as a perfect steriliser to any liquid filtered through it, whilst it permits the passage of 15—20 times as much liquid as does an equal surface of porous porcelain. J. J. S.

Schizomycetic Fermentation. By OSKAR EMMERLING (*Ber.*, 1899, 32, 1915—1918).—From a solution of malic acid, in which fermentation had been induced by inoculation with one drop of the liquid from putrefying flesh, a pure culture has been obtained of the *Bacillus lactis aërogenes*, first discovered by Escherich in the intestines of sucklings; it is a short, thick, non-mobile bacillus, and was identified by the form of its colonies, the milky-white appearance of the gelatin culture, the absence of spores, and especially the absence of colour in Gram's test. In a solution of bouillon and sugar, it develops hydrogen

and carbonic anhydride in molecular proportion. The pure culture acts on malic acid, reducing it to succinic acid almost quantitatively according to the equation $3C_4H_6O_5 = 2C_4H_6O_4 + C_2H_4O_2 + 2CO_2 + H_2O$. Alcohol is not produced, but traces of formic acid can be detected. The conversion of malic acid into succinic acid by brewers' yeast is due to bacteria, and does not take place with pure cultures. König has shown that tartaric acid is largely reduced to succinic acid by *Bacterium termo*, but *Bacillus aërogenes* appears to cause decomposition in other directions.
T. M. L.

Ionisation and Toxic Action of Metallic Salts: Copper Sulphate and Penicillium Glaucum. By Louis Maillard (*Bull. Soc. Chim.*, 1899, [iii], **21**, 26—29).—The toxic action of copper sulphate solutions on *Penicillium glaucum* decreases when the ionisation of the salt is diminished by the addition of another sulphate. This fungus was grown in nutritive solutions containing varying amounts of copper and ammonium sulphates; on comparing the solutions containing the same amount of the ammonium salt, the development of the organism is found to become slower as the quantity of copper sulphate increases, whereas the inhibitive action of equal quantities of the latter salt decreases as the dose of ammonium sulphate increases.
G. T. M.

Distribution and Functions of Cane Sugar in Plants. By Ernst Schulze (*Zeit. physiol. Chem.*, 1899, **27**, 267—291. Compare Abstr., 1895, ii, 364).—Cane sugar is widely distributed in the ripe seeds of plants, although often it is present only in small amount. It is also present in the seeds of conifers. It is doubtless of importance as a reserve material, to be used as soon as germination begins; but as it increases as growth goes on, it must fulfil other uses as well. Accompanying the cane sugar, other soluble sugars capable of inversion are also present, sometimes in larger quantities.
W. D. H.

Rôle of Iron Compounds and of Humic Substances in the Coloration of Water. Separation of these Substances under the Influence of Sunlight. By W. Spring (*Bied. Centr.*, 1899, **28**, 429; from *Bull. Acad. roy. Belg.*, 1897, **34**, 578—600).—Sea, lake, and river water might be expected to have a brown colour, when the amounts of iron and organic matter they contain are considered, similar to the colour produced by mixing dilute solutions of ferric chloride and peat-water. Such solutions, however, when exposed to light, gradually lose their dark colour, the change being accompanied by a separation of solid matter. It is concluded that the ferric salt oxidises the organic matter, and that the product has the property of forming insoluble compounds with metallic oxides. The function of iron in purifying natural waters is thus comparable with that of hæmoglobin in blood.
N. H. J. M.

Curdling of Milk after Addition of Soluble Calcium Salts. By Paul Vieth (*Bied. Centr.*, 1899, **28**, 418—419; from *Milchzeit.*, 1897, 193).—Hillmann found that the presence of soluble calcium salts gave rise to increased production of cheese, but in practice the increase was less than in experiments on a small scale.

In the experiments now described, which extended over several months, calcium chloride in quantities of 5, 7·5, and 10 grams was added to 100 kilograms of milk. Increased production of cheese was only observed in one case, and the increase was very small (0·3 per cent.); whilst in other cases there was a slight decrease in the amount of cheese. It is, however, pointed out that in no case was the quality of the cheese injured, and it is thought possible that addition of calcium salts may sometimes be of importance, for instance, after milk has been pasteurised. N. H. J. M.

Changes in the Surface and Subsoil of Peat-land under the Influence of Cultivation and of Manure. By G. Schliebs and H. Minssen (*Bied. Centr.*, 1899, **28**, 361—365; from *Mitt. Arbeiten. Moorversuchs-Stat., Bremen*, 4 *Ber.; Landw. Jahrb.*, 1898, **27**, *Ergänz.-Bd.*, IV, 525—547).—The more or less humified soil of peat-land as affected by tillage and manure is generally much less than 25 cm. deep, the subsoil being strongly acid peat which is usually not penetrated by the roots of crops. Manure constituents which reach the subsoil are therefore lost, and the loss is greatest in the case of newly cultivated peat-land which has only a slight power of absorption.

The effect of manuring on the surface soil was to increase the potash and phosphoric acid, but there was no increase in nitrogen when sodium nitrate had been applied, even in cases in which the nitrate could not have been completely used up. Generally, the increase of manure constituents in the soil is the greater the less complete the manuring with other constituents. Peaty soil which has been normally manured for some time accumulates so much potash and especially phosphoric acid that the amounts of manures may without injury be reduced; in such cases, it suffices to apply a slight excess over the amount removed by the crop. This conclusion is in accordance with the observation that the drainage from peat land contains but little potash.

Manuring with potash salts gives rise to loss of lime; basic slag may then be applied.

Loss of manures in the subsoil is greater in arable land than in meadows, and the loss is sufficiently great to render the adoption of subsoil-liming a very important question. N. H. J. M.

Peat Litter: Investigation of Soil Samples from Manure Heaps. By Adolf Emmerling (*Bied. Centr.*, 1899, **28**, 365—367; from *Landw. Wochenbl., Schleswig-Holstein*, **48**, No. 2).—Kainite, gypsum, and peat-meal all diminished or hindered loss of ammonia; but with gypsum, which was the more effective, as much as 50—60 per cent. of the total ammonia was lost in a week. Peat-meal retained ammonia during the first few days better than afterwards; its use is recommended for the absorption of liquid manure, but it should be renewed every day.

Peaty soil and subsoil, on which manure had been kept, was sampled to the depth of 10, 40, and 50 cm. and analysed. It was found that the percentage of nitrogen was high, whilst the percentages of phosphoric acid, and especially of potash, were very high. In the case of potash, the amount was even greater in the subsoil than at the surface, indicating that the power of absorption was exhausted in the surface soil. The amount of ammonia was also greatest in the subsoil. N. H. J. M.

Ammonium Salts and Chili Saltpetre [as Manures]. By Paul Wagner (*Bied. Centr.*, 1899, 28, 367—370; from *Deut. landw. Presse*, 1898, Nos. 30—31. Compare Abstr., 1898, ii, 258).—With regard to statements recently made that the production of ammonium salts would have increased long ago if agriculturists had required it, it is pointed out that the 2,000,000 cwt. produced in Germany have been entirely consumed there, and that considerable amounts of ammonium salts have been imported in addition.

The conditions which affect the action of ammonium salts and nitrates are of various kinds. The former have the advantage that, until nitrified, the nitrogen is fixed in the soil. In the case of sodium nitrate, the soda is often of use in light soils in increasing the power of retaining water, in supplying nitrogen and phosphoric acid to the plants, and also, to some extent, in compensating for a deficiency of potash. On the other hand, with clay soils, sodium nitrate gives rise to the production of hard crusts, rendering the application of lime necessary.

The author advises caution in accepting the one-sided results of those interested in ammonia production, and criticises the experiments of Klöpfer (*Deut. landw. Presse*, 1898, Nos. 25—26; and this vol., ii, 512). N. H. J. M.

Analytical Chemistry.

Employment of Adsorption in Analytical Separations. By Friedrich Goppelsroeder *Zeit. anal. Chem.*, 1899, 38, 291—292).—With reference to Trey's paper (this vol., ii, 182), the author directs attention to the fact that at various dates, commencing with 1861, he has published papers dealing very extensively with this subject (*Verhand. Naturforsch. Ges. Basel*; *Mitt. Sect. Chem. Gewerbe des k. k. Technolog. Gewerbe-museums in Wien*, 1888—1889). Amongst other applications of the method, he has employed it for the separation of mixed dyes. M. J. S.

Indicators for Alkalimetry. By F. Glaser (*Zeit. anal. Chem.*, 1899, 38, 273—278).—The Association of Bavarian Industrial Chemists at Speyer (see *Zeit. Untersuch. Nahr. Genussmittel*, 1899, 61) adopted a division of indicators into three groups, of which the following is an extension:

Group 1 (sensitive to alkalis).—(*a*) Tropæolin OO. (*b*) Methyl-ethyl-orange, dimethylamidoazobenzene. (*c*) Congo-red, benzopurpurin, iodeosin, cochineal. (*d*) Lacmoid.

Group 2.—(*a*) Fluorescein. (*b*) Alizarin, archil, hæmatoxylin, gallein. (*c*) Litmus. (*d*) *p*-Nitrophenol, tincture of guaiacum. (*e*) Rosolic acid.

Group 3 (sensitive to acids).—(*a*) Tropæolin OOO. (*b*) Phenolphthalein, turmeric, curcumin W, flavescin (Abstr., 1881, 193). (*c*) α-Naphtholbenzeïn. (*d*) Poirrier's blue C_4B.

In each group, the earlier members are more sensitive to alkalis and less so to acids than the later members. Those in group 2 are intermediate in sensitiveness between the other groups. By titrating the same acid with indicators of different groups, information may be obtained as to the relative strength of its acidity. Thus, if one acid can be titrated with equal sharpness by either litmus or lacmoid, whilst another can be titrated sharply with litmus but not with lacmoid, the former is the stronger acid of the two. In this way, it may be shown that in a homologous series of organic acids containing the same number of carboxyl groups, decrease in strength of acidity is concurrent with increase in molecular weight, and that among acids of equal basicity and approximately equal molecular weight, the strength of acidity increases with increase in the number of hydroxyl groups.

For the titration of bases, all the indicators can be used only when strong fixed bases are in question, the general rule being that an indicator shows a sharp colour change only when the product of the reaction is neutral to that indicator. Even to indicators which are not highly sensitive to acids, the mineral acid salts of weak bases react acid, probably in consequence of dissociation by water, in which condition the stronger component exhibits its action on the indicator. The ammonium salts of mineral acids react acid with all indicators, although only feebly with those of group 1. This is not the case with the normal salts of the fixed bases with mineral acids, but at high dilutions it is necessary to have regard to the hydrolysis of the indicator itself, and attention is directed to the use made of an ethereal solution of iodeosin by Mylius and Förster (Abstr., 1891, 1136). A similar dissociation occurs when a salt of a weak acid and strong base is dissolved in water, and therefore such salts react alkaline to indicators of the first and second groups. Water itself exhibits an acid reaction with the members of the third group, but an alkaline reaction with those of group 1, so that at very high dilutions a sensible excess of the respective reagents must be added to arrive at the point of apparent neutrality. It follows that in all cases where a weak acid in dilute solution is titrated by an alkali, using an indicator of group 3 (as in wine analysis, and the estimation of the Reichert-Meissl value of butter), the results may be seriously too high unless the alkali has been standardised under the same conditions of indicator and dilution. When working with 150—200 c.c., a sufficiently accurate correction may be made by deducting 0·3 c.c of *N*/10 alkali in the case of wine or beer, and 0·2 c.c. in that of the Reichert number from the amount required to give a permanent red colour with phenolphthalein. The presence of carbonic anhydride, or partial carbonatation of the alkali has not the injurious influence formerly attributed to it.

The effect of acid phosphates has in some cases been overlooked.

Thus, the latest draught of an agreement for establishing uniform methods of analysing foods throughout the German Empire leaves optional the use of litmus or phenolphthalein for the titration of the acid in beer. In consequence of the presence of acid phosphates, phenolphthalein in some cases indicates more than twice as much acid as does litmus. M. J. S.

Estimation of Iodine by Sodium Thiosulphate in the Presence of Cyanides. By W. Carrick Anderson and Andrew Smith (*J. Soc. Chem. Ind.*, 1899, **18**, 118—119).—Sulman and Teed have stated (*ibid.* 1898, **17**, 963) that cyanogen bromide may be accurately titrated by adding excess of potassium iodide and acidifying with hydrochloric acid; 1 mol. of cyanogen bromide liberating 2 mols. of iodine, besides yielding 1 mol. of hydrogen bromide and 1 mol. of hydrogen cyanide; if the liquid contains excess of cyanides, there will, of course, be a large excess of the latter, but this is stated not to interfere with the usual titration of the iodine with sodium thiosulphate.

It now appears from the tabulated experiments conducted by the authors that, although mere traces of hydrogen cyanide do not interfere, relative large proportions render the process quite useless. This is due to the formation of cyanogen iodide. L. de K.

Estimation of Oxygen in Gaseous Mixtures by Titration. By Grigori V. Chlopin (*Chem. Centr.*, 1899, i, 372; from *J. Russ. phys.-chem. Ges.*, **30**, 750—760).—A 150 c.c. flask is provided with a doubly perforated india-rubber cork. Through one of the openings passes a glass tube reaching nearly to the bottom of the flask, whilst the other holds a short glass tube. Each is fitted with an india-rubber tube which may be closed at a marked spot by means of a pinchcock. The true content of the flask is found by filling it with water up to the pinchcocks and weighing. By means of bellows or of an aspirator, the flask is filled with the air to be tested, and is placed in a water-bath having the temperature of the gaseous mixture After temperature and pressure have been recorded, the flask is closed by means of the pinchcocks. Through the smaller tube is now introduced first 15 c.c. of a solution made by dissolving 40 grams of crystallised manganous chloride in 100 c.c. of water, and then 15 c.c. of a solution prepared by dissolving 30 grams of potassium iodide and 32 grams of sodium hydroxide in 100 c.c. of water. The apparatus is closed and frequently shaken for 4—5 hours. The end of the reaction is known by the blackish precipitate assuming a yellowish-brown colour. Finally, 25 c.c. of strong hydrochloric acid is added and the liberated iodine is titrated with *N*/10 sodium thiosulphate, using starch water as indicator.

1 c.c. of thiosulphate represents 0·5592 c.c. of oxygen.

L. de K.

Estimation of Sulphur in Roumanian Petroleum. By G. Filiti (*Bull. Soc. Chim.*, 1899, [iii], **21**, 338—341).—The estimation of the sulphur in petroleum by the ordinary methods of oxidation is unsatisfactory and attended by various sources of error. Excellent results are obtained by combustion with oxygen in the calorimetric bomb in presence of a little water. Employing this method, six specimens of petroleum from Câmpina were found to contain 0·202—0·245 per cent. of sulphur, whilst six specimens of Bustenari petroleum yielded 0·118—0·193 per cent.

Marcellin Berthelot (*ibid.*, 513) points out that, in conjunction with André and Matignon, he had already established the use of the calorimetric bomb for the analysis of sulphur compounds. N. L.

Preparation of Standard Solutions of Sulphuric Acid. By Arthur Marshall (*J. Soc. Chem. Ind.*, 1899, **18**, 4—6).—The standardising of sulphuric acid by processes depending on the accurate weighing of substances supposed to be of known composition, is objected to, and it is held that Pickering's accurate determinations of the densities of sulphuric acid solutions (Trans. 1890, **59**, 64—184) provides a means of preparing standard solutions with far greater accuracy. Sulphuric acid of great purity is diluted with half its volume of water, and when cold its sp. gr. is taken at 18°, or 15·5°, or 15° by means of a 25 c.c. Sprengel tube. This acid keeps for any length of time, and from it standard solutions of any required strength may be rapidly prepared. To save calculation, the author appends two tables, one for specific gravities at 15° and the other at 18°. L. de K.

Technical Method for the Direct Estimation of Nitrogen in Illuminating and other Gases without the Aid of "Gas, Analysis Apparatus." By J. Kent Smith (*J. Soc. Chem. Ind.* 1899, **18**, 213).—The gas passes first through a meter and then into an expansion bottle fitted with an inlet and outlet tube, a thermometer, and a tube attached to a gauge. Before making the actual experiment all air is expelled from the apparatus. In case of high pressure, the gas must be passed through a Dreschel bottle containing a layer of sulphuric acid, and provided with a check clip to regulate the flow. The gas then passes slowly over copper oxide and metallic copper heated to redness in a combustion tube. The products of combustion, water, carbonic, and sulphurous anhydrides, and nitrogen, are collected in a bottle of known capacity filled with water and inverted in an ordinary pneumatic trough; the bottle can be fitted with a rubber stopper carrying a capillary glass top.

When the desired volume of gas has been collected, the stopper, with the tap closed, is inserted into the neck of the bottle under water, and the bottle transferred mouth downwards to an ordinary retort stand. Part of the water is then removed by suction, and strong aqueous soda is run in. This, on shaking, removes the carbonic and sulphurous anhydrides and leaves pure nitrogen. The inverted bottle is placed in an open vessel of water, the stopper is removed, and after a while the bottle slowly raised until the water is at the same level inside and outside. The stopper is then reinserted and the bottle removed and wiped. The water which it contains is carefully measured, and its volume, deducted from the capacity of the bottle, gives the volume of the nitrogen. The usual corrections for temperature, pressure, and aqueous vapour are then made. L. de K.

Analytical Methods for Distinguishing Proteid and Amidic Nitrogen. By JOHN W. MALLET (*Chem. Centr.*, 1899, i, 383; from *Bull.* **54** *U.S. Dept. of Agricult.*).—The author divides the nitrogenous compounds in question into three groups, according to their behaviour with phosphotungstic acid. To the first belong those which give no precipitate, even in concentrated solutions: glycocine, alanine, leucine, asparagine, aspartic acid, tyrosine, and allantoin. The second group includes those which are thrown down in concentrated solutions, but redissolve more or less readily on warming: glutamine, creatine, creatinine, hypoxanthine, carnine, and urea. Peptone gives a precipitate which becomes pasty on heating, and sensibly dissolves, but reappears on cooling. The third group, which yields a precipitate not dissolving on heating, includes egg-albumin, fibrin, casein, legumin, globulin, vitellin, myosin, syntonin, hæmoglobin, albumoses, gelatin, and chondrin.

When calculating the percentage of these substances from the amount of nitrogen yielded by the Kjeldahl-Gunning process, the following factors are proposed: For proteids and related compounds, 6·25; for meat-bases and the more simple animal amides, 3·05; for the more simple amides and amido-acids of vegetable origin, 5·15; and for undigested matters, 9·45. L. DE K.

Detection of Hydroxylamine. By EUGEN BAMBERGER (*Ber.*, 1899, **32**, 1805—1806).—One of the best reactions is the conversion of the hydroxylamine into benzhydroxamic acid, which is then tested for by means of the violet-red coloration it gives with ferric chloride; in order to avoid the formation of dibenzhydroxamic acid, it is advisable to use sodium acetate and benzoic chloride instead of sodium carbonate and the chloride as recommended by Lossen. The same test may be used for β-substituted hydroxylamines. J. J. S.

Estimation of Hydrazine. By ENRICO RIMINI (*Gazzetta*, 1899, **29**, 265—269).—Potassium iodate reacts with hydrazine sulphate even in the cold, nitrogen being evolved and iodine set free, 12 mols. of iodate being reduced by 15 mols. of hydrazine. The estimation of the hydrazine is carried out by adding to a solution of the sulphate a known volume of a standard solution of potassium iodate. The liquid is then boiled over a flame until it becomes colourless, showing that all the iodine is expelled. After cooling and acidifying with dilute sulphuric acid, the remaining excess of iodate is titrated with sodium thiosulphate in the usual way.

The author regards the reaction as taking place in two stages, hydrogen iodide being first formed, which then reacts with a further quantity of iodate; with bromates, a similar reaction takes place, but only on heating, whilst with chlorates there is no action. Hydroxylamine, phenylhydrazine, and semicarbazide also act on iodates with liberation of iodine.

These results are not in agreement with those obtained by Vitali (*Boll. Chim. Farm.*, April, 1899). T. H. P.

Volumetric Estimation of Carbon. By HENRI IMBERT and P. COMPAN (*Bull. Soc. Chim.*, 1899, [iii], **21**, 315—317).—This process is based on the reaction between a sulphuric acid solution of chromic acid and carbon, yielding chromic sulphate and carbonic anhydride. The unaltered chromic acid used is determined by adding excess of potassium iodide and titrating the iodine liberated with sodium thiosulphate.

The method of working is as follows: A known weight of the carbonaceous material is evaporated to dryness with an excess of a titrated solution of chromic acid and a little 4 per cent. sulphuric acid. When the liquid becomes syrupy, the colour will be yellow or yellowish-green if the chromic acid be in excess; if, however, the liquid be bluish-green, more chromic acid solution must be added. To the residue, diluted with water, potassium iodide in excess and more 4 per cent. sulphuric acid are added, and the iodine then extracted by shaking up the liquid several times with carbon bisulphide. The iodine solution is then shaken with 5 per cent. sodium hydrogen carbonate solution to neutralise the free acid, after which the liquid is titrated with sodium thiosulphate solution. Test analyses gave satisfactory results.

Hydriodic acid, in presence of hydrobromic acid, can be estimated by adding a cold sulphuric acid solution of chromic acid, which liberates the iodine but not the bromine; the iodine is then extracted with carbon bisulphide, and the solution titrated with thiosulphate solution as described above. T. H. P.

New Form of Potash Bulb. By W. Carrick Anderson (*J. Soc. Chem. Ind.*, 1899, **18**, 119).—The apparatus consists essentially of a tube ending in a pear-shaped bulb pierced laterally by four small holes. The latter is surrounded by a larger bulb, sealed to the tube at the top, while from the shoulder of this bulb three narrow-bore tubes pass off laterally, and terminate close to, and at equal distances from, the bottom of a third bulb, which forms the encasement for the apparatus. The two last bulbs are filled about half full with aqueous potash. Owing to the minute subdivision of the gas bubbles, the absorbing power of the alkali is rendered more effective than usual.

L. de K.

Absorption of Traces of Carbonic Anhydride in Gaseous Mixtures. By Félix Marboutin, Adrien Pécoul, and Marius Bouyssy (*Bull. Soc. Chim.*, 1899, [iii], **21**, 3—5).—Gautier's experiments (Abstr., 1898, ii, 641) appear to indicate that the last traces of carbonic anhydride in air are not removed by caustic potash solution, and that baryta water must be employed to effect a complete absorption. The authors find, however, that this gas is completely absorbed by passing air through a 2 per cent. solution of caustic potash in such a manner that each bubble remains in contact with the liquid for 15—20 seconds; this result is also attained with a solution of barium hydroxide. After this treatment, 200 litres of air showed no trace of carbonic anhydride; the amount of gas absorbed, when expressed in litres per 100 cubic metres of air, is practically the same, whichever of the two absorbents is employed. The analytical results are tabulated. G. T. M.

Decomposition of Silicates by Boric Anhydride. By PAUL JANNASCH and HERMANN WEBER (*Ber.*, 1899, **32**, 1670—1675. Compare Abstr., 1896, ii, 219).—Great difficulty is experienced in converting disthene (kyanite) into a form which is suitable for a complete analysis, since it is not attacked by ammonium fluoride or by boric anhydride under the conditions previously described, and fusion with potassium carbonate does not allow of the estimation of the alkali metals. A complete analysis has been effected by fusing with boric anhydride in the flame of an oxygen coal-gas blowpipe, cooling the crucible with water, dissolving the glassy mass by means of a solution of hydrogen chloride in methylic alcohol ("Salzsäure-methylester"), and evaporating three or four times with this solution to remove the whole of the boric acid.

Analyses are given of, I, disthene from Lincoln county, N. Carolina; II, quartz porphyry from the Kinzigthal:

SiO_2.	TiO_2.	Al_2O_3.	Fe_2O_3.	CaO.	MgO.	K_2O.	Na_2O.	H_2O.	Total.
37·16		60·89		0·33		1·35	0·46		100·19
71·76	trace	16·58	1·75	0·67	0·83	5·04	0·52	2·60	99·75

Topaz, and other minerals containing fluorine, can be analysed by boric anhydride fusion, since the whole of the fluorine is eliminated as boron fluoride, and not as silicon fluoride. Topaz, like disthene, is only attacked by using an oxygen coal-gas blowpipe. Two analyses gave $SiO_2 = 33·39$ and 33·35 per cent. T. M. L.

Quantitative Analysis without using Hydrogen Sulphide. By A. RAWITSCH (*Chem. Centr.*, 1899, i, 376—377; from *J. Russ. phys.-chem. Ges.*, **30**, 761—767).—The process resembles in principle the one proposed by Bischoff in 1862. After removing silver, mercurous mercury, and the bulk of the lead by hydrochloric acid, the neutralised liquid is heated with excess of yellow ammonium sulphide. The solution then contains the alkalis and the alkaline earths in addition to the tin-arsenic group, which may be precipitated by addition of hydrochloric acid.

The precipitate insoluble in ammonium sulphide is treated with dilute hydrochloric acid, which dissolves the sulphides of zinc, manganese, iron, and the hydroxides of aluminium and chromium, and also any phosphates of the alkaline earths. These must be separated as usual. The matter insoluble in hydrochloric acid is digested with nitric acid, which leaves the mercury sulphide undissolved; after expelling the excess of acid, the liquid is diluted, and the bismuth precipitated with ammonium chloride as bismuth oxychloride. The neutralised filtrate is then mixed with a little sodium thiosulphate, and a few drops of hydrochloric acid and boiled; copper and cadmium are precipitated as sulphides, whilst nickel and cobalt remain dissolved.

L. DE K.

Estimation of Gold and its Separation from Platinum and Iridium. By LUDWIG VANINO and L. SEEMANN (*Ber.*, 1899, **32**, 1968—1972).—The method recommended is the reduction of gold chloride to metallic gold by hydrogen peroxide in the presence of sodium or potassium hydroxide. Even in the cold, the reaction is complete in a few minutes, whereas the usual methods require 2—12 hours. When very dilute solutions are employed, it is advisable to warm the mixture for a short time after reduction, and then to add hydrochloric acid, as by this means the precipitate is rendered easier to filter; in no case must the hydrochloric acid be added until the excess of hydrogen peroxide has been destroyed by warming. The method cannot be employed for the estimation of gold in sodium aurichloride.

The same reaction may be employed as a qualitative test, as it is extremely delicate; 10 c.c. of a solution containing 0·00003 gram of gold, gives a slight red colour, with a bluish shimmer.

As platinum and iridium salts are not reduced in the cold by hydrogen peroxide and alkali, the reaction affords a simple method for the separation of gold from these two metals. J. J. S.

Colorimetric Estimation of Phosphoric Acid in Water. By Adolf Jolles (*Chem. Centr.*, 1899, i, 375; from *Arch. Hyg.*, **34**, 22—30).—The process is based on the yellow coloration produced when phosphates are heated with a nitric acid solution of potassium molybdate; the process is, of course, applicable only in very dilute solutions, as a solution containing more than 0·001 gram of phosphoric acid in 20 c.c. becomes turbid when heated at 80° with the reagent.

When testing waters, it is necessary to evaporate the water to dryness with a little nitric acid, and to heat for some time at 130° in order to render the silicic acid insoluble; the residue is then taken up with dilute nitric acid, filtered, and diluted to a suitable volume, of which 20 c.c. is used for the test.

The reagent is made by dissolving 8 grams of pure potassium molybdate in 50 c.c. of colourless nitric acid of sp. gr. 1·2; 1 c.c. of this solution precipitates 0·001 gram of phosphoric anhydride. The liquid for comparison is prepared by dissolving 53·23 grams of recrystallised disodium hydrogen phosphate in water, and diluting to 1 litre; before use, this solution must be further suitably diluted. L. de K.

Examination of Commercial Amylic Alcohol. By Henry Droop Richmond and F. R. O'Shaughnessy (*J. Soc. Chem. Ind.*, 1889, **18**, 107—109).—The amylic alcohol to be used in the Leffmann-Beam process, or in Gerber's modification of that method, should have a sp. gr. 0·8145 to 0·816 at 15·5° The boiling point should not exceed 130·5°, at which temperature 23·5 c.c. should distil over from 25 c.c. of the alcohol; 10 c.c. should give a clear and but slightly-coloured liquid on addition of 10 c.c. of hydrochloric acid of sp. gr. 1·17, and the addition of 1·5 c.c. of water should cause a permanent turbidity Tables are given for the correction of the density when taken at temperatures differing from 15·5°, and another table gives the density, boiling points, polarisation, and solubility of 14 samples of commercial amylic alcohol. L. de K.

Areometric Estimation of Dextrose in Urine. By Theodor Lohnstein (*Chem. Centr.*, 1899, 391; from *Allg. Med. Central Zeit.*, 1898, **58**).—The author has improved the process proposed by

Schlosser (this vol., ii, 185) which itself is a modification of the original method recommended by Roberts. The new process is as follows: 100 c.c. of urine, if containing much sugar, are fermented with 4 c.c. of yeast, but if the copper test shows but little sugar, 1 c.c. is sufficient; a little of the urine is first put into a graduated tube and after adding sufficient yeast to increase the volume by 4 c.c., the contents and the remaining urine are put into the fermentation flask. After fermenting for 12 hours at 35—40°, the clear liquid is poured off and its sp. gr. taken; 100 c.c. of the original sample is then mixed with 1·6 c.c. of a 1 per cent. solution of salt, and its sp. gr. is also taken at the same temperature. The difference in the two densities multiplied by 233 (or 230 if only 1 c.c. of yeast has been used) gives the amount of dextrose. L. de K.

Detection and Estimation of Formaldehyde. By Carl Neuberg (*Ber.*, 1899, **32**, 1961—1964).—When aqueous solutions of paradiphenyleneparadihydrazine hydrochloride (Abstr., 1887, 958) and formaldehyde are mixed and allowed to remain for a few minutes at the ordinary temperature, a precipitate of the *hydrazone*,

$$C_{12}H_8(NH{\cdot}N{:}CH_2)_2,$$

is thrown down in the form of slender needles; it turns orange-coloured at 166°, sinters at 202°, and melts at about 220°, is insoluble in all the ordinary solvents, and is readily decomposed by glacial acetic acid or mineral acids. It is instantaneously deposited in the pure form as a flocculent precipitate, when a colourless solution of the hydrochloride is slowly added to slightly more than the theoretical quantity of 40 per cent. formaldehyde solution at 60°. A solution of formaldehyde of 1 part per 5000 gives the reaction distinctly. Although not so delicate as Jorissen's phloroglucinol test or Lebbin's resorcinol test, it has the advantage that it serves to distinguish between formaldehyde and furfuraldehyde, or other aldehydes and ketones, since the corresponding hydrazones of all these are soluble in alcohol.

In the quantitative estimation, the aldehyde solution (1—2 parts per 1000) is added gradually to the warm aqueous solution of the hydrochloride and the hydrazone filtered, washed with hot water, alcohol, and pure ether, dried at 90°, and weighed. Or if no substance except formaldehyde is present which reacts with iodine and thiosulphate, the hydrazone may be filtered off and the excess of hydrazine estimated in the filtrate by Meyer's method (Abstr., 1887, 1042), or, still better, Blank and Finkenberger's method (this vol., ii, 188) for the estimation of formaldehyde can be employed. J. J. S.

[Estimation of Glycerophosphoric Acid.] By Jacques Cavalier and Pouget (*Bull. Soc. Chim.*, 1899, [iii], **21**, 364—366).—See this vol., i, 660.

Estimation of Salicylic Acid. By Wilhelm Fresenius and Leo Grünhut (*Zeit. anal. Chem.*, 1899, **38**, 292—301).—The authors have submitted to a critical investigation three methods of estimating salicylic acid, namely, (1) extraction with volatile solvents and weighing the residue from the evaporated extract; (2) an iodimetric process;

(3) Freyer's bromine absorption method (Abstr., 1897, ii, 608). The last alone gave satisfactory results. The first method failed in consequence of the volatility of salicylic acid, it being found impossible to expel the solvent (chloroform, ether, or light petroleum and ether) completely, either at 100° or at a lower temperature, without serious loss of salicylic acid. The second method gave very uncertain results, and the authors were unable to confirm the statement of Messinger and Vortmann (Abstr., 1890, 1473) that 1 mol. of salicylic acid consumes 6 atoms of iodine. The bromination method proceeds in accordance with the equations, $C_6H_4\cdot OH\cdot COOH + 8Br = C_6HBr_3\cdot OBr + 4HBr + CO_2$, and $C_6HBr_3\cdot OBr + 2KI = C_6HBr_3\cdot OK + KBr + I_2$, so that ultimately 6 atoms of halogen are consumed by one molecule of salicylic acid. At least 75 per cent. excess of bromine (in the form of an acidified mixture of bromate and bromide) must be used, and stronger solutions than were employed by Freyer are advisable. For 0·2 gram of sodium salicylate, there should be taken 100 c.c. of a solution containing 3 grams of sodium bromate and 20 grams of sodium bromide per litre. This, diluted with 300 c.c. of water, is first acidified with 30 c.c. of hydrochloric acid of sp. gr. 1·1. The 1 per cent. solution of the salicylate is then added with stirring, and after waiting for 5 minutes 30—40 c.c. of 10 per cent. potassium iodide solution is added and the free iodine titrated by thiosulphate. It is important not to add starch paste until the liquid is nearly decolorised. To estimate salicylic acid in presence of starch, it is necessary to separate the latter by dissolving in 90 per cent. alcohol and to employ an aliquot part of the filtered solution. M. J. S.

Delicate Test for Gallic Acid, Serving to Distinguish it from Digallic Acid and Pyrogallol. By Gioachino Griggi (*Chem. Centr.*, 1899, ii, 454; from *Boll. Chim. Farm.*, **38**, 5—6).—If to a 1 per cent. solution of gallic acid is added 1 c.c. of a solution of potassium cyanide (1 : 30), a clear, ruby-red coloration is developed which fades after a time, but is regenerated when the mixture is vigorously shaken; the same effect is obtained by adding hydrogen dioxide.

Digallic acid and pyrogallol give a yellowish-red colour with potassium cyanide. On adding hydrogen dioxide, the pyrogallol mixture turns yellowish-brown, whilst the digallic acid mixture gives a dirty white precipitate. L. de K.

Valuation of "Saccharin." By E. Emmet Reid (*Amer. Chem. J.*, 1899, **21**, 461—471).—Orthobenzoic sulphinide is hydrolysed by heating at 100° with 71 per cent. sulphuric acid during three hours or by boiling with dilute hydrochloric acid during two hours and then evaporating nearly to dryness; parasulphamidobenzoic acid is not hydrolysed under these conditions, but is completely hydrolysed when heated with concentrated sulphuric acid at 230—260° during several hours; neither compound is hydrolysed by boiling with caustic soda.

For the valuation of "saccharin," it is best to hydrolyse with hydrochloric acid, as the sulphinide is more completely hydrolysed, whilst the parasulphonamide, which liberates traces of ammonia when sulphuric acid is used, is not attacked at all by the hydrochloric acid.

The method of analysis is as follows: 0·650 gram "saccharin" is weighed into a 100 c.c. Florence flask and 50 c.c. of dilute hydrochloric acid (1 : 8) are added; the flask is gently boiled on a sand-bath for two hours with a reflux tube, and the contents are then allowed to boil down to 10 c.c.; the solution is diluted, transferred to a distilling flask, made alkaline with 10 grams of sodium hydroxide dissolved in 20 c.c. of water, the ammonia is carried over by a current of steam into 25 c.c. of standard acid, about *N*/7, and the excess of acid titrated with standard potassium hydroxide, using cochineal as an indicator.

It is shown that five different classes of nitrogen compounds can be separately estimated in one analysis, thus (1) ammonium salts by distilling with magnesia; (2) unstable amides such as paranitrobenzamide by distilling with caustic soda; (3) orthobenzoic sulphinide by heating with hydrochloric acid and again distilling with caustic soda; (4) parasulphaminobenzoic acid by heating with sulphuric acid and distilling with caustic soda; and (5) other nitrogen compounds by Kjeldahl's method. T. M. L.

Estimation of Fat in Milk. By M. KÜHN (*Chem. Centr.*, 1899, i, 388—389; from *Milch-Zeit.*, 27, 807—808, 823—825, 835—837). —A thorough investigation has been made as to the merits of Soxhlet's areometric process for the estimation of fat in milk; this process consists in determining the sp. gr. of ether before and after agitating with alkaline milk; the difference in gravity is then a measure of the amount of fat.

The author recommends the process, but points out a few important facts. Ether saturated with water such as is wanted in this process, does not keep well, alcohol being gradually formed to some extent; the ether should therefore be re-agitated with water containing a little potassium hydroxide just before use. Another occasional source of error is the inaccuracy of the hydrometers employed. L. DE K.

Apparatus for Rapid Analysis of Milk. By GEORGE D. MACDOUGALD (*J. Soc. Chem. Ind.*, 1899, **18**, 235—238).—The author's process is, chemically, that of Leffmann-Beam, but the apparatus, which is fully illustrated in the paper, and which cannot be properly explained without reproducing the drawings, is quite different, and is specially devised to enable a large number of samples to be accurately analysed in a short time. For instance, the well-known Leffmann-Beam bottle is replaced by a kind of U-tube provided with a pear-shaped bulb to hold the mixture of milk and acid. After the milk has been introduced, the amylic alcohol, or a mixture of it with hydrochloric acid, is added from a specially-constructed bottle, and the sulphuric acid is also introduced by means of an apparatus consisting of a series of tubes, or calibrated bulbs, fed by a tube common to all. The mixing is done by drawing air through the bulb by means of an aspirator, and, to facilitate the rising of the fat, a mixture of sulphuric acid and water of higher sp. gr. than the mixture of milk and acid is added, so as to occupy the lower part of the bulb.

The tube is calibrated by means of milk the percentage of fat of which has been carefully determined, say, by Adams' method. The tubes are whirled in a special apparatus, allowing the use of a steam-bath. Three minutes is ample for 500—600 revolutions, but at higher speeds the time may be shortened. The fat is read off by placing each bulb in a lantern, the image being projected on to a scale.

L. DE K.

Detection of Arachis Oil in Olive Oil. By M. VIERTH (*Chem. Centr.*, 1899, i, 383—384; from *Pharm. Zeit.*, **43**, 924).—The author agrees with Tortelli and Ruggeri (Abstr., 1898, ii, 653) that the only trustworthy test for the presence of arachis oil in olive oil is the melting point of the isolated arachidic acid.

Thirty grams of the sample is saponified with 12 per cent. alcoholic potash, the fatty acids are liberated by means of hydrochloric acid, and then dissolved in warm 90 per cent. alcohol. This solution is precipitated with alcoholic solution of lead acetate, and the precipitate is extracted with ether. The insoluble mass is then decomposed with hydrochloric acid, and the fatty acids dissolved in excess of warm 90 per cent. alcohol. When cold, the arachidic acid crystallises out, and is collected on a filter and washed with cold alcohol; it is then dissolved in boiling alcohol, evaporated in a tared dish and weighed, allowance being made for the slight solubility in cold alcohol.

The melting point should be 71°, but it will be necessary to carefully recrystallise several times from hot alcohol before a satisfactory result can be obtained.

L. DE K.

Analysis of Aniline Oils and Aniline Salt. By ADOLF LIEBMANN and ARTHUR STUDER (*J. Soc. Chem. Ind.*, 1889, **18**, 110—112). —*Estimation of Water in Aniline Oil.*—100 c.c. of the sample are distilled and 10 c.c. collected in a narrow, graduated measure holding 15 c.c.; 1 c.c. of brine is added, the whole is well shaken, and left to settle. The increase in volume of the brine, + a correction of 0·3 c.c., gives the amount of water.

The boiling is now continued, and the temperature is observed in intervals of 10 c.c.; 80 per cent. of the oil should boil within 0·5°. *Specific gravity.*—This should be taken with the distillate after the water has been removed; good oils have a sp. gr. from 1·0265—1·0270 at 15°. *Sulphur compounds.*—These are found to be given off as hydrogen sulphide on boiling. The sample is therefore boiled for some hours in a reflux apparatus, while a current of carbonic anhydride is passed through, carrying the evolved hydrogen sulphide into a measured quantity of $N/10$ silver nitrate; at the end of the operation, the silver sulphide is removed, and the silver remaining in the solution estimated; from the loss, the amount of sulphur is calculated.

Solubility in Dilute Hydrochloric Acid.—This is the most important test, as it reveals the presence of objectionable non-basic substances, such as nitrobenzene or naphthalene. For the detection of ortho- or para-toluidine, the authors use Reinhardt's method (Abstr., ii, 608), with only a very slight modification. This process consists in dissolving the sample in hydrobromic acid and adding standard solution of mixed potassium bromide and bromate until the liquid contains free bromine. Another portion of the sample is dissolved in dilute hydrochloric acid and precipitated with oxalic acid, which combines with the paratoluidine and the aniline. These may then be recovered from the washed precipitate by means of warm aqueous potash, and then weighed and again titrated with bromine. As aniline absorbs 3 mols. of bromine, whilst the toluidines only absorb 2 mols., the respective amounts of aniline and toluidines may be readily calculated. The authors find that pure aniline may be dissolved in hydrochloric acid, but that for mixtures, the use of hydrobromic acid is necessary; or a properly made mixture of hydrochloric acid and potassium bromide may be substituted. Instead of using iodide starch-paper as indicator, they estimate the small excess of bromine added by means of potassium iodide and sodium thiosulphate, using starch-water as indicator.

Anaylsis of Aniline Salt.—The sample may be conveniently analysed by Reinhardt's bromine process, the appearance of the sample being of great value to an expert. Water is estimated by drying for 24 hours in a desiccator. As the presence of free acid is of serious importance, the authors estimate it as follows: 5 grams of the salt are dissolved in 10 c.c. of water, and 5 drops of crystal violet (1 : 1000) added, and the mixture compared with a similarly made solution of aniline salt free from acid. If now the sample shows acidity—namely, a bluer or even a green shade—a decinormal aqueous solution of aniline is run in until the colours are exactly alike, and the amount of free acid is readily found by calculation. L. DE K.

Estimation of Alkaloids by Iodine Solution. By MAX SCHOLTZ (*Zeit. anal. Chem.*, 1899, **38**, 278—280. See Abstr., 1896, ii, 282, 682; this vol., ii, 390, 534).—In reply to Kippenberger's contention that the difference between the author's results and his own is due to a difference in the amount of potassium iodide in their respective solutions, the author states that he employed the usual *N*/20 iodine solution containing 10 grams of potassium iodide per litre, but points out that in consequence of the different molecular weights of the alkaloids a different absolute weight of iodide in each case would be associated with an uniform molecular addition of iodine, if one and the same solution were employed for all, and would, moreover, vary with every change in the proportion of iodine solution added.

M. J. S.

Estimation of Alkaloids by Iodine Solution. By CARL KIPPENBERGER (*Zeit. anal. Chem.*, 1899, **38**, 280—287. See preceding abstract).—The author shows that when the conditions have been similar, Scholtz has obtained results agreeing with his own, but maintains that Scholtz has used an iodine solution containing more potassium iodide than is suitable for the present purpose. Since in the course of an analysis the alkaloids would be obtained and weighed in a state of approximate purity, it is easy to prepare from a standard specimen a solution of nearly the same concentration as the one to be titrated, and to standardise the iodine solution therewith, and so titrate the product of the analysis under identical conditions. M. J. S.

General and Physical Chemistry.

Diffusion of Light by Solutions. By Walthère Spring (*Rec. Trav. Chim.*, 1899, **18**, 233—246).—Solutions of the chlorides, bromides, chlorates, and nitrates of sodium, potassium, ammonium, barium, and calcium were placed in a small, spherical flask, clarified by adding a few drops of a colloidal solution of ferric, or better still, cadmium or zinc, hydroxide, and allowing the precipitated hydroxide to settle (this vol., ii, 537); the flask was then placed in the cone of light from a powerful electric lantern, so that the apex of the cone coincided with the centre of the flask (compare Picton and Linder, Trans., 1892, 143); in no case was there a visible cone of light within the flask. Solutions of salts of the earthy or heavy metals cannot be clarified in this way, as they react with hydroxides to form basic salts; they can only be compared with distilled water in respect of their power of diffusing light. The chlorides, chlorates, sulphates, and nitrates of zinc, cadmium, manganese, cobalt, and nickel do not exhibit a cone appreciably more distinct than that obtained with distilled water; on the other hand, the neutral solutions of salts of aluminium, chromium, iron, copper, mercury, and lead, especially the chlorides of the first metals, exhibit a very marked cone. If a little of the corresponding metallic hydroxide is dissolved in the solution of the chloride of iron, aluminium, zinc, cadmium, or mercury, the cone becomes still more marked, the addition of a few drops of hydrochloric acid causing it to disappear, however; with the chlorides of copper, nickel, and cobalt, no such result is obtained. It will be noted that the salts of which the solutions exhibit no cone are just those which are largely dissociated into their ions, and which contain metals that form hydroxides more or less soluble in water. The salts which exhibit a cone are those which are known to undergo electrolytic hydrolysis to a certain extent, and of which the metals form hydroxides insoluble in water; the appearance of the cone is probably due to the presence of a small quantity of the hydroxide in colloidal solution.

Dilute solutions of certain indisputably colloidal substances were examined, and all found to exhibit a very marked cone; such are aqueous solutions of gelatin, gum arabic, and dextrin in water; of colophony, Canada balsam, and gum-lac in alcohol; also solutions of sodium soap, alkali silicates (dilute), Williamson's blue, Prussian blue, and phenyl blue. If there is any suspicion that the appearance of a cone may be due to fluorescence, a yellow screen is interposed in the path of the beam of light; if the cone persists, it was due, in part at any rate, to diffusion; if it vanishes, it was due to fluorescence, which is occasioned only by the more refrangible rays. Magenta and vesuvine (phenyl-brown) exhibit a marked cone in aqueous solution; their solutions in alcohol, however, give no more pronounced a cone than alcohol itself does. Tannin and sodium soap both give a very marked cone in aqueous solution; the latter in alcohol-ether solution exhibits no cone except such as is due to fluorescence, whilst tannin in acetic acid solution gives a cone that is in part due to fluorescence, but appears to be due in part to diffusion. C. F. B.

An X-Ray Photometer. By ALEXANDRE HÉBERT and GEORGES REYNAUD (*Bull. Soc. Chim.*, 1899, [iii], **21**, 392—394).—For the purpose of studying the absorption of Röntgen rays by different liquids, a modified form of the Duboscq colorimeter has been devised. The instrument is supported on a wooden stand, and in place of the mirror a vacuum tube is arranged underneath. The liquids, absorbing powers of which are to be compared, are contained in two cylinders placed side by side, the depths of the liquid layers being varied by means of hollow glass pistons, the displacements of which can be read off on a vertical scale. The lower faces of the pistons are covered with fluorescent discs, the platinocyanide being uppermost; gutta-percha coatings protect the discs from the action of the liquids in which they are immersed. The pencils of light emitted by the fluorescent discs are brought into contact in the ordinary way by means of reflection from the interior faces of two glass parallelipipedons. The field thus consists of two halves, which are made of equal intensity by varying the positions of the pistons. T. H. P.

Specific Absorption of X-Rays by Metallic Salts. By ALEXANDRE HÉBERT and GEORGES REYNAUD (*Bull. Soc. Chim.*, 1899, [iii], **21**, 394—402).—By means of the instrument described in the preceding abstract, the absorption of Röntgen rays by solutions of a large number of metallic salts has been studied. One of the cylindrical tubes was filled with distilled water and its piston kept in a fixed position, and in the other was placed the salt solution containing the gram-molecular weight (or, in some cases, a simple multiple or sub-multiple of it) per litre. The piston in the second cylinder being adjusted to give equal luminosity of the two halves of the field, the difference between the heights of the two pistons gives the length of a column of water having an absorption equal to that caused by the salt. On examining in this way different metallic salts of the same acid, it is found that, in general, the absorption increases with an increase in the atomic weight of the metal; further, the numbers obtained seem to divide the metals into a number of groups, the salts of the members of any one group having approximately the same molecular absorption. For instance, in the case of the metallic chlorides: those of hydrogen, lithium, and sodium give numbers varying from 11·8 to 15·5 (compared with a column of distilled water 41·5 mm. in height); those of potassium, ammonium, magnesium, and calcium have values lying between 23·5 and 25·9, that is, about double those of the first group; those of iron, manganese, copper, cobalt, zinc, and nickel have numbers ranging from 33·1 to 34·8, or about treble those of the first group; and for the heavy metals, chromium, barium, strontium, cadmium, gold, tin, platinum, and mercury, the limiting values are 37·3 and 40·1. On arranging the metals according to the absorptions of their nitrates, an almost identical series is obtained. A similar classification into groups is noticed for salts containing the same metal but different acids; in this case also, it is approximately true that the absorption of a salt increases with the molecular weight of the corresponding acid. T. H. P.

Aqueous Solutions of Double Salts. II. Chlorides. By Harry C. Jones and Kenjiro Ota (*Amer. Chem. J.*, 1899, **22**, 5—14. Compare Jones and Mackay, Abstr., 1897, ii, 396).—The authors' experiments show that the conductivity of aqueous solutions of the double chlorides $2KCl,ZnCl_2$; $KCl,CdCl_2$; $NaCl,AlCl_3$, and $2NH_4Cl,HgCl_2$, tends, with increasing dilution, to become equal to the sum of the conductivities of the constituent salts; it thus appears that, with infinite dilution, complete dissociation of the double chloride into its constituents would occur. In concentrated solution, however, the observed conductivities are much lower than those calculated for complete dissociation into the constituent salts; this indicates that the double chlorides named are, to some extent, capable of existing as such in concentrated solutions, and confirms Remsen's view, that the double chlorides are definite chemical compounds. A similar conclusion was formerly drawn by Jones and Mackay (*loc. cit.*) in the case of some of the alums, but owing to the ease with which these undergo complete dissociation in aqueous solution, the results were less well defined than those now recorded.

Under the same conditions of concentration and temperature, the zinc potassium chloride is much less dissociated than the corresponding cadmium salt, and this, in turn, less than the aluminium sodium or the ammonium mercury double salts. W. A. D.

Electrolysis of Ammonium Thiosulphate. By Paul Pierron (*Bull. Soc. Chim.*, 1899, [iii], **21**, 477—481).—Ammonium sulphide is the only product obtained at the cathode, whilst at the anode, sulphur with various proportions of sulphurous, sulphuric, trithionic, and tetrathionic acids are formed. The amounts of sulphur and sulphuric acid increase, whilst that of tetrathionic acid decreases, as the current increases. R. H. P.

Magnetic Properties of the Elements. By Stefan Meyer (*Monats.*, 1899, **20**, 369—382).—The magnetic susceptibility of a number of the elements, partly in the form of powder, partly in larger pieces, has been determined. The coefficient of susceptibility for each element, when divided by the number of gram-atoms per litre, gives the atomic magnetism. A table is drawn up showing the atomic magnetism for each element, and embracing the numbers given by Königsberger (*Ann. Phys. Chem.*, 1898, [ii], **66**, 732), as well as those obtained by the author. It appears that a general relation exists between the susceptibility of the elements and their atomic weights. J. C. P.

Thermal Properties of Normal Pentane. By J. Rose-Innes and Sydney Young (*Phil. Mag.*, 1899, [v], **47**, 353—367).—The relations of temperature, pressure, and volume have been determined for normal pentane by the methods previously employed in the case of isopentane (*Proc. Phys. Soc.*, **13**, 602—657). The equation $p=bT-a$ at constant volume holds for a wide range of volumes; as in the case of isopentane, the deviations are greatest at intermediate volumes.

For each volume there is one, and only one, temperature at which the gas has its pressure equal to that required by the laws of a perfect gas, this temperature T being given by the expression $a/(b - R/v)$. When v is greater than 8, the values of T for normal pentane are fairly constant, the mean being 838·5°; the corresponding temperature for isopentane was 842·4°.

The variations of b and a with the temperature have been studied. When the quantity $1/av^2$ is plotted against $v^{-\frac{1}{2}}$, a discontinuity is found about the volume 3·4, the point where the corresponding curve for isopentane was discontinuous. The value of $1/av^2$ is always smaller for normal pentane than for isopentane at the same value of v; the difference diminishes as the volume increases. Thus, if the pressure is expanded in ascending powers of the density, the coefficient of the second power is different for the two isomerides.

J. C. P.

Determination of the Solidifying Point. By Al. A. Shukoff (*Zeit. angew. Chem.*, 1899, 563—564).—The apparatus is a modification of Eykmann's apparatus for cryoscopic determinations. It consists of a cylindrical vessel 3 cm. wide and 11 cm. high, which has been sealed into another 5 cm. wide. In the interspace between the two vessels a Crookes' vacuum has been made, the inner vessel thus being surrounded by a Dewar's vacuum jacket.

The determination of the solidifying point is conducted by partially filling the inner vessel with the clear melted substance; a thermometer showing fifths of a degree is then introduced through a perforated cork until its bulb reaches the centre of the liquid. When the temperature is about 5° above the expected solidifying point the apparatus is continually and strongly shaken up and down until the mass has become opaque. According to the nature of the substance, the temperature remains constant for some time (paraffin), or it begins to rise and then remains constant for some time (fats). This constant point is then recorded as the solidifying point. L. de K.

Heat of Oxidation of Sodium. By Robert de Forcrand (*Compt. rend.*, 1899, **128**, 1449—1452).—According to Beketoff (Abstr., 1884, 1247, and 1888, 1244), Na_2O sol. + Aq = Na_2O diss. develops 54·766 Cal. and K_2O sol. + Aq = K_2O diss. + 67·40 Cal. Combining these values with the heats of reaction of sodium and potassium with water for which the means of the determinations of Thomsen and Joannis are taken, there is obtained: Na_2 sol. + O gas = Na_2O sol. + 100·084 Cal. and K_2 sol. + O gas = K_2O sol. + 94·90 Cal. As this is the only case in which the heat of formation of a sodium compound is greater than that of the corresponding potassium compound, the author has revised Beketoff's numbers. His method is to dissolve mixtures of known composition of Na_2O and Na_2O_2 in dilute hydrochloric acid; from the measurement of the heat evolved and a knowledge of the heat of solution of the peroxide, the heat of solution of Na_2O is obtained. The mean value found is: Na_2O sol. + Aq = Na_2O diss. + 63·865 Cal., a number considerably higher than Beketoff's. From this, Na_2 sol. + O gas = Na_2O sol. + 90·985 Cal., which is less than the corresponding number for potassium.

T. H. P.

The Oxides of Sodium and the Chemical Function of Water compared with that of Hydrogen Sulphide. By ROBERT DE FORCRAND (*Compt. rend.*, 1899, **128**, 1519—1522. Compare this vol., ii, 95).—From the equations H_2O sol. + Na sol. = H gas + NaOH sol. + 31·19 Cal., and NaOH sol. + Na sol. = H gas + Na_2O sol. − 11·685 Cal., it is seen that the quantities of heat developed during the successive replacement by sodium of the hydrogen atoms in the water molecule differ by 42·875 Cal., which is an abnormally large difference. The corresponding heat changes for the action of sodium on hydrogen sulphide are 44·45 and 31·80 Cal., giving a difference of 12·65, and a mean value of 38·12. When the hydrogen atoms of the hydroxyl groups of catechol are successively replaced by sodium, the amounts of heat developed are 43·61 and 33·08 respectively, the difference being 10·53, and the mean 38·34; the action of sodium on phenol develops 38·42 Cals. From these numbers, the author concludes that hydrogen sulphide, considered thermally, is a true diphenol with the formula H-S-H, but that water is not a symmetrical compound and must be represented by the formula H-OH. T. H. P.

Determination of the Heats of Combustion of some Organic Compounds. By B. ZOUBOFF (*Chem. Centr.*, 1899, i, 586—587; from *J. Russ. Chem. Soc.*, 1898, **30**, 926—950).—The heats of combustion of the following organic compounds were determined by Berthelot's calorimetric method. In calculating the kilogram-calories per gram-

	As liquids.		As gases.
	At constant volume.	At constant pressure.	At constant pressure.
Octane	1310·7	1313·4	1328·4
Decane	1621·1	1624·3	1644·5
Trimethylethylene	801·0	802·5	(807·8)
Hexylene	958·7	960·5	—
Hexamethylene	942·2	943·9	—
Methylpentamethylene	943·9	945·6	—
Propylic alcohol	483·6	484·4	497·2
Isopropylic alcohol	477·9	478·7	490·8
Butylic alcohol	642·5	643·7	658·8
Isobutylic alcohol	639·8	640·9	655·5
Tertiary butylic alcohol	633·3	634·4	647·7
Fermentation amylic alcohol	769·5	798·0	814·9
Dimethylethylcarbinol	789·3	790·7	805·4
Heptylic alcohol	1111·7	1113·8	(1137·9)
Methylethylketone	586·3	587·1	596·9
Methylpropylketone	739·5	740·6	(752·1)
Methylisopropylketone	738·8	739·9	750·9
Diethylketone	740·5	741·6	753·3
Methylbutylketone	901·0	902·5	916·7
Pinacoline	897·6	899·1	(912·1)
Dipropylketone	1057·3	1059·1	1075·5
Methylhexylketone	1212·9	1215·0	1235·3
Dimethylic carbonate	343·5	343·5	354·3
Diethylic carbonate	652·5	653·1	667·6

molecule of substance, Bartoli and Stracciati's data (compare also *J. Russ. Chem. Soc.*, 1898, **30**, 946) for the specific heat of water, and Luginin's determinations of the specific and latent heats of evaporation of the various compounds, have been employed. In the cases, however, where the figures are in brackets, the latter constants were calculated from those of analogous compounds. The heats of combustion of isomeric compounds of the same series are not identical. In the original paper, the numbers obtained by the employment of Regnault's determinations of the specific heat of water at 20° are also quoted and are slightly higher than those on p. 589. E. W. W.

Cryoscopic Measurements. By FRANÇOIS MARIE RAOULT (*Bull. Soc. Chim.*, 1899, [iii], **21**, 610—612).—A reply to Ponsot's criticisms (this vol., ii, 546) of the author's work. T. H. P.

Temperatures of Maximum Density of Aqueous Solutions of Alkali Chlorides. By LOUIS C. DE COPPET (*Compt. rend.*, 1899, **128**, 1559—1561).—By the method previously described by the author (Abstr., 1895, ii, 343), the temperature of maximum density of a number of solutions of different strengths of potassium, sodium, lithium, and rubidium chlorides have been measured. The difference between the temperatures of maximum density of the solution and of pure water, divided by the number of gram-molecules of the chloride per litre of solution, is termed the molecular depression of the temperature of maximum density, and in the case of solutions of potassium chloride it apparently decreases slightly as the concentration increases. For solutions of sodium and rubidium chlorides, no regular change of this molecular depression with the concentration can be traced, but with lithium chloride, an increase in the concentration corresponds with an increase in the molecular depression of the maximum density temperature, and the value of this latter is only about one-half the values for the other alkali chlorides. T. H. P.

Dissociation of Gases under Constant Pressure and in presence of an Excess of one of the Products of Dissociation. By RUDOLF WEGSCHEIDER (*Monats.*, 1899, **20**, 307—319).—For a gas which dissociates into two simpler molecules, the equation of equilibrium, when the pressure is taken as constant, leads to the result $a_{\infty} = a^2$, where a_{∞} and a are the degrees of dissociation, (1) when an infinitely large excess, (2) when no excess, of either product is present. Thus, as the excess of one of the products of dissociation increases, the degree of dissociation falls until it reaches the limiting value given by the above equation. In more complicated cases, the degree of dissociation in presence of an excess of one product depends on the relative number of molecules concerned. Similar relations hold for solutions: when a reaction in dilute solution is accompanied by a change in the osmotic pressure, further dilution shifts the equilibrium in the direction of increased osmotic pressure.

In the light of the relation $a_{\infty} = a^2$, the author discusses the experiments of Wurtz on the dissociation of phosphorus pentachloride, and concludes that this substance, which was supposed to be undissociated in presence of a large excess of phosphorus trichloride, was in reality dissociated to the extent of 3—10 per cent. J. C. P.

Dissociation of the Hydrochloride of Methylic Ether. By RUDOLF WEGSCHEIDER (*Monats.*, 1899, **20**, 320—335).—The author reviews Friedel's work on the dissociation of the compound OMe_2,HCl, and calculates the equilibrium constant for each of his experiments. With the help of the most consistent of Friedel's numbers, the formula $\log 10^5K_c = -1078{\cdot}061/T + 4{\cdot}71704$ is obtained; the values of K_c given by this equation and those given by experiment are compared, and on the whole a satisfactory agreement is found except at temperatures under 10°. Of Friedel's methods, the one depending on a vapour density determination seems to give the best results, but it is pointed out that, owing to the very high degree of dissociation of the methylic ether hydrochloride, an exact investigation of the equilibrium is a very difficult task. J. C. P.

Direct Measurement of the Osmotic Pressures of very dilute Solutions of Sodium Chloride. By A. PONSOT (*Compt. rend.*, 1899, **128**, 1447—1448. Compare this vol., ii, 546).—The osmotic pressures of dilute solutions of sodium chloride (0·110 to 0·115 gram per litre) have been determined by measuring the head of water required to maintain equilibrium between water and the solution with a semi-permeable membrane between. The values obtained for the coefficient *i* of Van't Hoff's relation vary from 1·76 to 1·81. From these results and those of Pickering (Abstr., 1892, 1045) on the depression of the freezing point of salt solutions, the author concludes that *i* has a limiting value less than, and differing appreciably from, 2.
T. H. P.

Rate of Explosion in Gases. By DAVID L. CHAPMAN (*Phil. Mag.*, 1899, [v], **47**, 90—104).—A mathematical paper in which formulæ are deduced for the maximum rate of explosion and the maximum pressure in the explosive wave. The velocity of explosion is calculated for a number of cases, and the values found are compared with those given by experiment. The formula for the maximum velocity of explosion is also used to calculate some specific heats at constant volume. The data necessary for the calculations have been obtained from Dixon's work on this subject. J. C. P.

Equilibrium of Three Component Systems forming Two Liquid Phases. By B. DE BRUYN (*Rec. Trav. Chim.*, 1899, **18**, 87; from *Proc.-verb. Acad. roy. Sci. Amsterdam*, Jan. 26, 1899).—The equilibrium of the four following systems has been examined: (1) Ammonium sulphate, ethylic alcohol, water; (2) potassium carbonate, methylic alcohol, water; (3) potassium carbonate, ethylic alcohol, water; (4) sodium sulphate, ethylic alcohol, water.

In the first case at a definite temperature, several solutions were obtained homogeneous, but separating into 2 layers when either heated or cooled.

In (3), at 17°, the upper and lower layers contain respectively 91·5 and 0·2 of ethylic alcohol and 0·06 and 52·2 of potassium carbonate per cent., and this composition remains almost constant between −18° and +75°. In (2) the upper and lower layers at 17° contain respectively 69·6 and 5·7 of methylic alcohol and 6·25 and 48·4 of potassium carbonate per cent., and in this case, the temperature exercises a great influence. C. F. B.

A Method for Carrying Out Chemical Reactions Under High Pressures. By B. H. Hite (*Amer. Chem. J.*, 1899, **22**, 80—86).—The reagents are placed in a platinum tube similar in construction to the ordinary collapsible lead paint-tubes, which is then closed by means of a stopper or screw-cap, and placed in a lead cylinder 5—6 inches long and ¼ inch in diameter; the lead tube is filled with water, and is closed with a lid and placed in a very thick-walled, hollow steel cylinder, into which it accurately fits. The lead tube rests on a steel plug which closes the lower end of the cylinder and rests on the bed-plate of a hydraulic press; the pressure of the ram is communicated to the lid of the lead tube by means of a steel piston, accurately fitting the inside of the hollow cylinder. The platinum tube serves simply to separate the reagents from the water by which the pressure is communicated, and can be replaced by a lead tube if the reagents used are without action on this metal. W. A. D.

Facilities for Standardising Chemical Apparatus offered by the American and Foreign Governments. By Louis A. Fischer (*J. Amer. Chem. Soc.*, 1898, **20**, 912—927).—An account of methods used in graduating chemical apparatus in the office of Weights and Measures, U.S.A., as compared with those in other countries.

An account, illustrated with photographs of the apparatus, is given of a very quick but accurate method of graduating flasks not too large to be filled with mercury. L. de K.

An Electric Drying Oven. By Theodore W. Richards (*Amer. Chem. J.*, 1899, **22**, 45—49).—The author points out the great advantage of an electric current as a source of heat for drying ovens. An ordinary sixteen-candle incandescent lamp gives heat enough to raise a small oven padded with asbestos to 120° or 130°. He describes a very effective oven which is readily constructed from materials present in every laboratory. The original must be consulted for details. W. A. D.

Inorganic Chemistry.

Maximum Quantity of Chlorides contained in Sea Air. By Armand Gautier (*Bull. Soc. Chim.*, 1899, [iii], **21**, 391—392).—The chlorine contained in the air at the Rochedouvres lighthouse was determined by aspirating a known volume of the air through a long plug of glass wool, which was afterwards washed with hot water, the filtered washings being titrated with decinormal silver solution. The air was collected during both the day and night, the weather being fine and dry, and the wind west-north-west, and blowing from the open sea; the height of the aspirator was 9 metres above sea-level. For a mean temperature of 15°, a quantity of chlorine corresponding with 0·022 gram of sodium chloride per cubic metre of air was found. The author regards this as the maximum quantity of salt which air can retain in suspension. T. H. P.

Existence of Iodine in the Atmosphere. By ARMAND GAUTIER (*Bull. Soc. Chim.*, 1899, [iii], **21**, 456—463).—Less than 1/500 milligram of free iodine, or gas containing iodine, is present in about 4000 litres of dust-free air of Paris; similarly, the dust-free air from the sea, forest, or mountain districts contains no appreciable quantity of iodine. No iodine, in the form of soluble salts, is present in the small particles of dust in the air. The air from Paris and from the sea contain respectively 0·0013 milligram and 0·0167 milligram of iodine in 1000 litres. This iodine is probably present in small vegetable organisms suspended in the air. It is detected by filtering the air through glass wool, and afterwards fusing the latter with potash.

R. H. P.

Action of Iodine on Alkalis. By E. PÉCHARD (*Compt. rend.*, 1899, **128**, 1453—1456).—When iodine is dissolved in sodium hydroxide solution, it exists in three forms, namely, as hypoiodite, iodate, and free iodine, the proportions of these three varying with the conditions. The free iodine diminishes and approaches a limit as the ratio of soda to total iodine increases; for the ratio $I:2NaOH$ there is 2 per cent. of free iodine, and this proportion remains appreciably constant as the ratio of soda to iodine is further increased. The amount of hypoiodite formed is approximately proportional to the quantity of soda, and when the mixture has the composition $I:2NaOH$, the percentage of iodine in the form of iodate is a maximum, and equal to 92 per cent. of the total iodine. On heating a mixture of the composition $I + NaOH$ from 0° to 80°, the amount of free iodine remains sensibly constant, the hypoiodite decreasing and the iodate increasing with rise of temperature. The composition of the mixture gradually changes on standing, the amount of free iodine slowly diminishing and the hypoiodite undergoing conversion very gradually into iodate.

T. H. P.

Electrolytic Preparation of Fluorine in a Copper Vessel. By HENRI MOISSAN (*Compt. rend.*, 1899, **128**, 1543—1545).—Of all metals, besides platinum, copper is least attacked when in contact with a solution of potassium fluoride in anhydrous hydrogen fluoride undergoing electrolysis. For the preparation of fluorine, the author finds it possible to make the electrolytic vessel of copper, but the electrodes must be of platinum; the copper probably becomes coated with a layer of insoluble copper fluoride, and, in the case of the electrodes, this coating would diminish the current. T. H. P.

Quantity of Oxygen in the Atmosphere, compared with that in the Earth's Crust. By GERALD STONEY (*Phil. Mag.*, 1899, [v], **47**, 565—566).—A calculation is made showing that the quantity of oxygen in the atmosphere is less than a ten-thousandth part of the combined oxygen in the earth's crust. J. C. P.

Some Properties of Liquid Sulphurous Anhydride. By AUGUST HARPF (*Zeit. angew. Chem.*, 1899, 495—496).—Lange (this vol., ii, 478) has stated that commercial liquid sulphurous anhydride, which may contain as much as 1 per cent. of water, attacks iron at a temperature of 70°, forming a solid crust of ferrous sulphite and thiosulphate; the anhydrous acid does not affect the metal.

The author thinks that at first ferrous sulphite and ferrous hyposulphite are formed; the latter then splits up into water and ferrous thiosulphate. L. DE K.

Action of Liquid Sulphurous Anhydride on Iron. By A. LANGE (*Zeit. angew. Chem.*, 1899, 595—597).—In reply to Harpf (preceding abstract), the author states that he admits the possibility of the presence of hyposulphurous acid in the commercial liquid sulphurous acid, but he has not been able to actually prove its occurrence. The yellow colour of the commercial article is no proof whatever of the presence of hyposulphurous acid, and is often caused by small quantities of lubricating oil.

An analysis is given of a black, crumbly mass formed by corrosion of iron in a refrigerating machine, in which moist sulphurous anhydride was used as cooling agent. Both ferrous sulphite and thiosulphate were detected. L. DE K.

The Absorption of Nitrogen. By WALTHER HEMPEL (*Zeit. anorg. Chem.*, 1899, 21, 19—20).—The best material for the absorption of nitrogen in the preparation of the argon gases is obtained by mixing 1 gram of finely divided magnesium with 5 grams of coarsely powdered calcium oxide and 0·25 gram sodium in pieces of 1—2 mm. diameter.

The volume of nitrogen absorbed in 1 hour by the following materials is as follows: 1 gram of magnesium 14·5 c.c., 1 gram of lithium 75·5 c.c., 1 gram of magnesium and 5 grams of calcium oxide 122 c.c., 1 gram of magnesium and 3 grams of calcium oxide 50 c.c., 1 gram of magnesium and 8 grams of calcium oxide 31·4 c.c., 5 grams of calcium oxide and 1 gram of sodium 0 c.c., 1 gram of magnesium, 5 grams of calcium oxide and 0·25 gram of sodium 326·2 c.c., 1 gram of magnesium, 5 grams of calcium oxide and 0·11 gram of lithium 228 c.c., and 1 gram of magnesium, 5 grams of calcium oxide and 0·1 gram of sodium 287 c.c. E. C. R.

Fluorine Derivatives of Phosphates, Sulphates, Selenates, Tellurates, and Dithionates. By RUDOLPH F. WEINLAND and J. ALFA (*Zeit. anorg. Chem.*, 1899, 21, 43—69).—Potassium monofluorophosphate (Abstr., 1898, ii, 217) crystallises in the monoclinic system, [$a:b:c = 0·8501:1:0·6268.\ \beta = 78° 55'$].

Cæsium monofluorophosphate, $PFl(OH_3)\cdot OCs$, obtained by evaporating a solution of tricæsium phosphate (2 mols.) with cæsium carbonate (1 mol.) to dryness, and dissolving the residue in excess of hydrofluoric acid, resembles the potassium and rubidium salts in crystalline form and properties. The corresponding sodium, ammonium, and silver salts could not be obtained.

Tripotassium difluorodisulphate (*loc. cit.*) crystallises in the monoclinic system [$a:b:c = 1{\cdot}013:1:0{\cdot}8218$. $\beta = 71° 21'$]. *Cæsium difluorodisulphate*, $S_2O_7Fl_2Cs_3H + H_2O$, is obtained in a similar manner to the potassium salt which it resembles. The corresponding sodium and ammonium salts could not be prepared.

Tripotassium difluorodiselenate, $Se_2O_7Fl_2K_3H + H_2O$, obtained by evaporating a solution of potassium selenate in excess of hydrofluoric acid in a desiccator over lime, crystallises in forms similar to those of potassium fluorosulphate; it quickly decomposes on exposure to the air with loss of water and hydrogen fluoride, and when heated evolves water and hydrogen fluoride, and then oxygen, leaving a residue of selenate and selenium dioxide. The *rubidium* salt, $Se_2O_7Fl_2Rb_3H + H_2O$, is similar to the potassium salt. The cæsium and sodium salts could not be obtained. *Ammonium monofluoroselenate*, $SeO_3OHFl(NH_4)_2$, obtained on concentrating a solution of ammonium selenate in excess of hydrofluoric acid, crystallises in flat prisms belonging to the rhombic system, quickly loses its lustre on exposure to the air, and dissolves easily in water.

Potassium difluorotellurate, $TeO_3Fl_2K_2 + 3H_2O$, obtained by evaporating a solution of telluric acid (1 mol.) and potassium hydroxide (2 mols.) to dryness on the water-bath and dissolving the residue in a slight excess of hydrofluoric acid, crystallises in microscopic, octahedral, monoclinic crystals, is fairly stable in dry air, but when heated evolves water and a small quantity of hydrogen fluoride, or at a higher temperature oxygen, and leaves a residue of tellurium dioxide and potassium fluoride. It is difficult to dissolve in water, yielding a faintly acid solution, and cannot be recrystallised from hydrofluoric acid. The *rubidium* salt, $TeO_3Fl_2Rb_2 + 3H_2O$, obtained in a similar manner to the potassium salt, crystallises in small, colourless crystals similar to and more easily soluble than those of the potassium salt. The corresponding ammonium and sodium salts could not be prepared.

Potassium difluorodithionate, $S_2O_5Fl_2K_2 + 3H_2O$, crystallises from a warm saturated solution of potassium dithionate in hydrofluoric acid, and is extremely unstable. When exposed to the air, it quickly decomposes with evolution of water and hydrofluoric acid, leaving a residue of potassium dithionate; when heated, water and hydrofluoric acid are at first evolved, then sulphurous anhydride, and a residue of potassium sulphate is obtained. The *rubidium* salt is similar in all respects to the potassium salt. *Cæsium monofluorodithionate*, $S_2O_5FlOHCS_2 + H_2O$, obtained by saturating warm hydrofluoric acid with cæsium dithionate, crystallises in small, colourless prisms, and is more stable than the preceding potassium salt, but similar to it in other respects. Sodium and ammonium salts could not be obtained.

E. C. R.

Decomposition of Carbonic Oxide by Metallic Oxides. By Octave Boudouard (*Compt. rend.*, 1899, **128**, 1522—1523. Compare this vol., ii, 287, 365, and 417).—When carbonic oxide is decomposed at 800° in presence of oxide of nickel or cobalt, or of ferric oxide, the amount of decomposition depends on the time of reaction. The speed of reaction at 800° is greater than at 650°, equilibrium being attained in 2 hours at the higher temperature, and only after 6 hours at the lower. In the presence of nickel or cobalt oxide at 800°, no further change occurs after the gaseous mixture contains 7 per cent. of carbonic anhydride and 93 per cent. of carbonic oxide. T. H. P.

Decomposition of Carbonic Anhydride in presence of Carbon. By OCTAVE BOUDOUARD (*Compt. rend.*, 1899, **128**, 1524—1525. Compare this vol., ii, 417).—In continuation of the experiments previously described (*loc. cit.*), the reaction between carbonic anhydride and carbon at 800° and at 925° has been studied. Different forms of carbon were used, namely, wood charcoal, bone black, coke, and carbon reduced from carbonic oxide, the speed of reaction being greatest with the wood charcoal, and least with the bone black. As is the case at 650°, so also at 800° the decomposition ceases when the composition of the gaseous mixture is the same as that obtained by the action of carbonic oxide on nickel or cobalt oxide at the same temperature—in this case, 7 per cent. of carbonic anhydride and 93 per cent. of carbonic oxide (see preceding abstract). At 925°, the proportion of carbonic anhydride in the gaseous mixture is 4 per cent. T. H. P.

Action of Hydrogen Sulphide on Silicates. By PAUL DIDIER (*Compt. rend.*, 1899, **128**, 1286—1288).—Many natural silicates are partially attacked by hydrogen sulphide at 1400°, change colour, and become more soluble in acids, part of the metallic constituents having been converted into sulphides. The quantity which becomes soluble varies with the nature of the mineral from about 7 per cent. (peridote) to 45 per cent. (powdered commercial cerite). In most cases, a small quantity of sulphuric acid is formed, and condenses in the cool part of the tube. The silica displaced by the hydrogen sulphide remains in the free state, usually non-crystalline, or in some cases forms more acidic silicates. Occasionally an annular deposit forms in the cool part of the tube, consisting either of silicon or a silico-formic compound. C. H. B.

"Condensed" Metallic Hydroxides. By ERNEST SCHLUMBERGER (*Bull. Soc. Chim.*, 1899, [iii], 21, 467—468).—A claim for priority and a criticism of Wyrouboff and Verneuil (this vol., ii, 224). The author prefers the expression "condensation" to that of "polymerisation" used by Wyrouboff and Verneuil, since the phenomena observed by them (see this vol., ii, 423) are in the majority of cases accompanied by a loss of water. R. H. P.

Hydration of Calcium Oxide. By PAUL ROHLAND (*Zeit. anorg. Chem.*, 1899, **21**, 28—36).—The author has examined qualitatively the hydration of calcium oxide, especially with regard to the influence of a third substance. The hydration is accelerated by the presence of hydrochloric or nitric acid, aluminium, calcium, or barium chloride, acetic acid, sodium acetate, lactic acid, asparagine, or ethylic alcohol. It is retarded by the presence of boric acid, sodium or potassium hydroxide, calcium chromate, potassium dichromate, acetaldehyde, glycerol, cane sugar, or dextrose. The following compounds do not influence the hydration: ammonia, calcium hydroxide, sodium and lithium chlorides, potassium hydrogen carbonate, and potassium nitrate. E. C. R.

Mixed Halogen Lead Salts. By VICTOR THOMAS (*Compt. rend.*, 1899, **128**, 1329—1331).—When lead iodide is dissolved in a hot saturated solution of lead bromide and the liquid is allowed to cool, lead iodide is first deposited, then greenish-yellow needles of the compound $PbI_2,3PbBr_2$, and finally lead bromide. If the first precipitate of lead iodide is not removed, it is gradually converted, as the liquid cools, into the bromiodide. When the double salt is heated with water, it decomposes and dissolves, but is formed again when the liquid cools. Similar phenomena are observed with a solution of the iodide in the chloride. The formation and decomposition of these salts at different temperatures is in accordance with Van't Hoff's law connecting with the heat of formation of the compounds, the changes in composition produced by changes in temperature. Since the simple and double salts can crystallise together, it follows that the composition of the crystals will oscillate between two limits, but they are not to be regarded as mere mixtures of isomorphous compounds (compare Abstr., 1898, ii, 585, and this vol., ii, 420). C. H. B.

Copper Reduced at a Low Temperature. By ALBERT COLSON (*Compt. rend.*, 1899, **128**, 1458—1460).—On reducing cupric oxide at temperatures near 200° by means of hydrogen or carbonic oxide, an active form of the metal termed nascent copper is obtained. In contact with bromine, it takes fire, even after being cooled to $-21°$, or after placing in a vacuum; in moist air, however, it loses this property. With nitric acid, it does not form nitric oxide, but is more rapidly attacked than ordinary copper filings. In density, magnetic properties, and action on a nitric acid solution of a ferric salt, it shows no difference from copper reduced at a red heat. On hammering, "nascent" copper loses its active properties. T. H. P.

Vapours Emitted by the two Varieties of Mercuric Iodide. By DÉSIRÉ GERNEZ (*Compt. rend.*, 1899, **128**, 1516—1519).—The vaporisation of mercuric iodide was observed in a special vacuum apparatus in which the temperatures of both the vaporising and the condensing surfaces could be varied. The vapour given off at all temperatures by the yellow crystals deposits yellow, orthorhombic crystals, no matter what may be the temperature of the cooler surface on which deposition occurs. The yellow crystals are also obtained from the vapour emitted when the red variety is vaporised at any temperature from 25° up to the point at which the change into the yellow form takes place. If, however, the cool surface is lightly rubbed with the red crystals, the form deposited is also red. T. H. P.

Action of Water on Ammonium and Potassium Mercuriodides. By MAURICE FRANÇOIS (*Compt. rend.*, 1899, **128**, 1456—1458). —Ammonium mercuriodide, $HgI_2,NH_4I + H_2O$, is decomposed by water, mercuric iodide being precipitated; at ordinary temperatures, the solution formed contains approximately one molecule of HgI_2 to two of NH_4I. To determine whether the compound $HgI_2,2NH_4I$ exists in the solution, the action of water on the double iodide has been studied at three different temperatures, and it is found that, at 55°, about half the mercuric iodide of the salt is precipitated, whilst at 20° and 90° the quantities of mercuric iodide thrown down are respectively much less than and much greater than the half of that contained in the double iodide. Similar behaviour is shown by potassium mercuriodide, $HgI_2,KI + 5H_2O$, so that when water acts on these compounds, the solution contains no definite salt, but is merely a solution of mercuric iodide in the alkali iodide solution.

T. H. P.

Constitution of the Oxides of the Rare Metals. By GRÉGOIRE N. WYROUBOFF and AUGUSTE VERNEUIL (*Compt. rend.*, 1899, **128**, 1573—1575. Compare this vol., ii, 224 and 423).—Several hydrated salts of cerium contain water of crystallisation in such proportion that the number of molecules is only integral when multiplied by 3, and in certain double salts 3 mols. of cerous oxide are combined with 1 mol. of a salt of a monad metal; these facts have been advanced as an argument in favour of the trivalency of cerium. The authors call attention to the invalidity of such an argument, which entirely disregards the existence of such compounds as $(CdSO_4)_3 + 8H_2O$, exactly analogous to $(CeSO_4)_3 + 8H_2O$; $5HgCl_2$, RbCl; and $ThSO_4$, K_2SO_4, the formation of which would thus disagree with the supposed quadrivalency of thorium.

On evaporating at 60—70° a solution of cerium, lanthanum, didymium, or yttrium sulphate in concentrated nitric acid, well-crystallised compounds of the general formula $2(MSO_4),M(NO_3)_2 + nH_2O$ are obtained, n being equal to 2 for the cerium and lanthanum compounds, and 6 for those of didymium and yttrium. The substances are very stable, and can be recrystallised from concentrated nitric acid without undergoing change. Further, Job (Abstr., 1898, i, 356) has prepared stable compounds of the composition $2MC_2O_4,MCl_2 + 6H_2O$. The formulæ of these two series of substances show that the oxides exist in the oxalates and sulphates in a triple form, one of the MO groups having chemical functions different from those of the other two.

T. H. P.

Lanthanum Peroxide. By PETR G. MELIKOFF and L. PISSARJEWSKY (*Zeit. anorg. Chem.*, 1899, **21**, 70—72).—*Lanthanum peroxide* is obtained by dissolving pure lanthanum oxide in nitric acid, and after adding hydrogen peroxide, precipitating with potassium hydroxide. The white, gelatinous precipitate, which is similar in appearance to aluminium hydroxide, is washed with hydrogen peroxide, then with water, and dried on a porous plate. The determination of the ratio of active oxygen to La_2O_3 gave $2O:La_2O_3$, so that the formula is $La_2O_5 + nH_2O$ or $HLaO_3 + nH_2O$. When treated with dilute sulphuric acid, it yields hydrogen peroxide, with concentrated acid, ozonised oxygen, and with carbonic anhydride, hydrogen peroxide and lanthanum carbonate; when left in a desiccator over sulphuric acid and soda lime, it gradually decomposes with loss of oxygen, but is not completely decomposed even by prolonged heating at 200°. Lanthanum peroxide, like the oxide, has basic properties, and does not combine with bases to form salts.

E. C. R.

Ferric "Hydrogel." By JACOBUS M. VAN BEMMELEN (*Rec. Trav. Chim.*, 1899, **18**, 86; from *Proc.-verb. Acad. roy. Sci. Amsterdam*, Jan. 26, 1899. Compare Abstr., 1893, ii, 169).—A study of the isotherm, for 15°, of dehydration, rehydration, and re-dehydration of gelatinous ferric hydroxide shows that the composition of this substance varies with the amount of moisture in the air; no definite hydrate exists, contrary to Spring's conclusion (Abstr., 1898, ii, 520), and the substance is merely Fe_2O_3 containing absorbed water. C. F. B.

Chromic Chloride. By PAUL ROHLAND (*Zeit. anorg. Chem.*, 1899, **21**, 37—42).—The violet chromic chloride is almost insoluble in boiling water, but if 1/20,000 part of chromous chloride is present, it is easily dissolved, being converted into the green chloride, and the solution, on cooling, deposits hygroscopic needles of the composition $CrCl_3 + 6H_2O$. The author explains the conversion on the dissociation theory, and finds that it is retarded by ethylic or methylic alcohol or acetone. E. C. R.

Uranium Compounds. By JULES ALOY (*Bull. Soc. Chim.*, 1899, [iii], **21**, 613—616).—In contact with hot potassium or sodium hydroxide solution, crystallised uranous sulphate is rapidly converted into a black, crystalline product, the liquid remaining colourless. This product, which is readily freed from acid and alkali by washing with hot water, has the composition $UO_2 + 2H_2O$, and remains unchanged in the air for several days; on heating, it is completely transformed into the green oxide, and as it is soluble in dilute acids, it affords a ready means of preparing uranous salts.

Uranous chloride is formed when a hydrochloric acid solution of uranic hydroxide, or of the green oxide, is exposed, in presence of a small quantity of alcohol, to the action of sunlight. From the solution thus prepared, it can be obtained in pale green crystals by the addition of ether.

Berzelius found that, on heating a solution of uranous chloride for some hours, a black precipitate was produced; the author finds this to be an oxychloride of the composition $UCl_4,5UO_2 + 10H_2O$. It can be kept in the air for a long time without turning yellow, and on drying over sulphuric acid presents a shining conchoidal fracture; washing with water removes some of the chlorine.

Uranous oxalate can be obtained crystalline (1) by leaving uranous hydroxide in contact with oxalic acid solution, or (2) by adding oxalic acid solution to a sulphuric acid solution of uranous hydroxide; it forms faintly greenish-white, elongated rectangular prisms of the composition $U(C_2O_4)_2 + 6H_2O$, and is insoluble in water. Potassium or sodium hydroxide solution decomposes it, giving a voluminous precipitate of uranous hydroxide, and on heating in a current of hydrogen, it is converted into dioxide.

On mixing recently precipitated uranous hydroxide with a cold dilute solution of arsenic acid, uranous arsenate, $UH_2(AsO_4)_2 + 2H_2O$, gradually separates in thin, pale green needles, stable at ordinary temperatures; it is insoluble in water, but dissolves partially in excess of arsenic acid. T. H. P

Mineralogical Chemistry.

Indium in Tungsten Minerals. By ELIZABETH A. ATKINSON (*J. Amer. Chem. Soc.*, 1898, **20**, 811—813).—The author confirms Hoppe-Seyler's observation as to the presence of indium in wolframite from Zinnwald, and in support of his suggestion that the indium was really present in the zinc blende accompanying this mineral, shows that neither indium nor zinc was present in other tungsten minerals, namely, wolframite from Cornwall, hübnerite from Colorado, and scheelites from New Zealand and Bohemia. L. DE K.

Phosphorus and Arsenic in Minerals of the Island of Elba. By P. TOSO (*Zeit. Kryst. Min.*, 1899, **31**, 406 ; from *Boll. R. Com. Geol.*, 1897, **28**, 216—248).—Thirteen analyses by Mattirolo and Aichino of iron ores from Elba show the presence of Fe, 59·38—67·26 ; P, trace to 0·785 ; As, trace to 0·315 per cent. L. J. S.

Iodine and Bromine in Fumarole Products from Vesuvius. By R. VITTORIO MATTEUCCI (*Zeit. Kryst. Min.*, 1899, **31**, 399 ; from *Rend. Accad. Sci. Fisiche, etc., Napoli*, 1897, [iii], **3**, 151—152).—Iodine and bromine have been detected in the fumarole products of the Vesuvian eruption of 1895. L. J. S.

Selenium in Fumarole Products from Vesuvius. By R. VITTORIO MATTEUCCI and ERCOLE GIUSTINIANI (*Zeit. Kryst. Min.*, 1899, **31**, 399 ; from *Rend. Accad. Sci. Fisiche, etc., Napoli*, 1897, [iii], **3**, 100—101).—A bright red incrustation, formed during the eruption of July 3, 1895, was found to contain selenium, together with fluorine, phosphorus, and boron. L. J. S.

Saline Sublimation from Vesuvius. By PASQUALE FRANCO (*Zeit. Kryst. Min.*, 1899, **31**, 399 ; from *Rend. Accad. Sci. Fisiche, etc., Napoli*, 1897, [iii], **3**, 192—196).—A greenish or white granular sublimation product of the last Vesuvian eruption has the following composition :

$NaCl$.	KCl.	K_2SO_4.	$CuCl_2+2H_2O$.	$Fe_2Cl_6+6H_2O$.	$PbCl_2$.	$CaCl_2$.	Total.
77·08	8·44	8·44	3·21	1·61	0·24	0·98	100·00

Also traces of $MgCl_2$, NH_4Cl, $ZnCl_2$, and $TlCl_2$, but no helium.
L. J. S.

Sodium Hydrogen Carbonate on Vesuvian Lava. By R. VITTORIO MATTEUCCI (*Zeit. Kryst. Min.*, 1899, **31**, 400 ; from *Rend. Accad. Sci. Fisiche, etc., Napoli*, 1897, [iii], **3**, 223—232).—The presence of sodium hydrogen carbonate, together with sodium carbonate, sulphate, and chloride, is noted in a saline incrustation on Vesuvian lava of 1895. L. J. S.

Composition of Parisite from Montana. By SAMUEL L. PENFIELD and CHARLES H. WARREN (*Amer. J. Sci.*, 1899, [iv], **8**, 21—24).—The rare mineral parisite has recently been found in Montana in a white, loosely coherent matrix, having the appearance of a decomposed rhyolite. The specimens are supposed to have come from near Pyrites, Ravalli Co. The yellowish-brown crystals average 1 mm. in diameter and 1 cm. in length, and are scattered with crystals of pyrites throughout the white matrix. They are hexagonal, and show oscillations between prisms and steep pyramids; goniometric measurements are given. Analysis of impure material gave I. Analysis II is of a pure crystal from Muso, Colombia, S.A., the original locality for parasite (analyses I and II by Warren).

	CO_2.	F.	Ce_2O_3.	$(La,Di)_2O_3$.	CaO.	Fe_2O_3.	Na_2O.	K_2O.	H_2O.	Gangue.	Total less O for F.	Sp. gr.
I.	22·93	5·90	26·14	28·46	10·98	0·80	0·69	0·19	0·26	[6·13]	100·00	4·128
II.	24·22	6·82	30·67	29·74	10·70	0·20	0·20	0·10	—	—	99·78	4·302

The second analysis gives the formula $2(R'''F)CO_3 + CaCO_3$ or $(R'''F)_2Ca(CO_3)_3$. L. J. S.

Formula of Tourmaline. By H. Rheineck (*Zeit. Kryst. Min.*, 1899, **31**, 385—386).—The formula for tourmaline recently proposed by Penfield and Foote is $H_{20}B_2Si_4O_{21}$ (this vol., ii, 334). If, however, the fluorine in their analyses is combined with the metals, the ratio of Si : H is 4 : 19·33. This taken with the extreme ratios, Al : Si = 1 : 0·75 and 1 : 1·21, pointed out by Rheineck in 1893, gives the two general formulæ, $H_5Al_8B_3Si_6O_{31}$ and $H_{14}Al_5B_3Si_6O_{31}$, with the intermediate members $H_8Al_7B_3Si_6O_{31}$ and $H_{11}Al_6B_3Si_6O_{31}$. Such acids with B_3Si_6 could contain 27, 29, 31, or 33 hydroxyl groups, and this agrees with the results of Riggs' (1888) analyses. L. J. S.

Origin of Glaucophane Rocks. By Harry Rosenbusch (*Chem. Centr.*, 1899, i, 451; from *Sitz.-ber. Akad. Berlin*, 1899, 706—717).—The arfvedsonite-amphiboles (arfvedsonite, riebeckite, hastingsite, &c.) occur only as original constituents of eruptive rocks, whilst the "glaucamphiboles" or glaucophane-amphiboles (glaucophane, gastaldite, crossite) occur only in dynamo-metamorphic rocks. The chemical composition (as shown by two quoted analyses) of glaucophane-rocks is identical with that of a normal gabbro magma, and there is also microscopic evidence to show that glaucophane-rocks owe their origin to the dynamo-metamorphism of gabbros, diabases, &c. In these rocks, the alkali is present in the glaucophane, whilst in orthoamphibolites, which may also be derived from gabbros, &c., the alkali is present in felspar. L. J. S.

Eruptive Rocks of Cape Blanc in Algeria. By Louis Duparc and E. Ritter (*Compt. rend.*, 1899, **128**, 1356—1358).—The eruptive rocks of Cape Blanc in Algeria contain biotite, with inclusions of apatite or more rarely of zircon; hornblende (also with inclusions of apatite) usually much altered in appearance, and small in quantity; plagioclases, chiefly of a somewhat basic type. There is no regular succession of the felspathic zones. Quartz is rarely present and is much altered. The second consolidation is sometimes a colourless isotropic glass, with perlitic fissures, but in most cases the matrix is crystalline and of a distinctly micrograpulitic structure. Quartz is abundant and encloses chloritic biotite and opaque grains of an iron compound. The microgranulitic matter contains SiO_2, 63·0 to 67·88; Al_2O_3, 14·45 to 17·40; Fe_2O_3, 5·03 to 5·74; CaO, 5·19 to 5·71; MgO and alkalis, 6·27 to 8·38; loss on heating, 0·47—0·48. The rocks are neovolcanic quartz-porphyries of a basic character with microgranulitic or vitrophyric structure. C. H. B.

Iodine in the Mineral Waters of Royat. By André Duboin (*Compt. rend.*, 1899, **128**, 1469—1470).—The author has tested water from the Eugénie spring at Royat for the presence of iodine. Potassium hydroxide solution was added until alkaline to prevent the formation of calcium or magnesium iodide and the estimation then carried out by Gautier's method (this vol., ii, 477); by this means, no iodine was detected. On evaporating the water to dryness and fusing the residue with caustic potash, 0·04 milligram of iodine per litre was found. The author is therefore of opinion that the iodine is present in organic combination; this would explain the fact that the waters lose some of their characteristic properties on keeping. T. H. P.

Fluorine in Mineral Waters. By Charles Lepierre (*Compt. rend.*, 1899, **128**, 1289—1291).—The author maintains that, contrary to the view of Parmentier (this vol., ii, 501), small quantities of fluorine are not uncommon in mineral waters, their presence having been observed by many chemists. The mineral water of Gerez, in the north of Portugal, is exceptional; it contains only 0·296 to 0·310 gram of solid matter per litre, but of this 0·022 to 0·025 gram is an alkali fluoride, probably sodium fluoride. The presence of this unusual constituent may be an important factor in the well-known therapeutic value of this water in liver complaints.

For the detection of fluorides in natural water, the formation of microscopic crystals of sodium silicofluoride with their well-defined form is frequently of value. C. H. B.

Physiological Chemistry.

Influence of Alcohol on Respiration in Man. By Hermann Wendelstadt (*Pflüger's Archiv.*, 1899, **76**, 223—275).—Large doses of alcohol increase the respiration in most cases in men who are not fatigued, although sometimes only to a small extent. In fatigued individuals, the increase is always seen, and is much greater. This action is seen at its best if the alcohol is administered as a wine with rich bouquet. W. D. H.

Modifications in Metabolism produced by Diphtheria Toxin. By Diarmid Noël-Paton, James Craufurd Dunlop, and Ivison Macadam (*J. Physiol.*, 1899, **24**, 331—355).—Under the influence of the diphtheria toxin in the dog, the digestion and absorption of proteids are not interfered with, but there is a great increase in proteid katabolism; the amounts of urea, ammonia, and uric acid are not affected, but the increase of urinary nitrogen is in some other form. Similarly, the sulphur, but not the sulphuric acid, is increased in the urine. The phosphorus of the urine is not increased, so apparently there is no increase in the katabolism of nucleins. There is no marked alteration in the proportion of sodium and potassium, but the excretion of chlorine is markedly lessened. W. D. H.

Action of Various Substances on the Activity of Saliva. By F. KÜBEL (*Pflüger's Archiv.*, 1899, **76**, 276—305).—With regard to sodium chloride, the more concentrated the starch, the more concentrated must a salt solution be to exercise an inhibitory influence on saliva; or, to put it another way, a salt solution of such a strength that it delays the salivary digestion of starch of a certain degree of concentration will further its activity when the starch is more concentrated. Using dilute solutions of corresponding strengths, salivary digestion is furthered by sodium fluoride, then follow in the order named the chloride, bromide, and iodide, the last having the least action; as the saline solutions increase in strength, the action becomes less and less, and finally the activity of saliva is hindered. The corresponding potassium salts act similarly, but less energetically, than those of sodium. Alkali diminishes, but very dilute acid favours, salivary action. W. D. H.

Relative Volume or Weight of Blood-corpuscles and Plasma. By GEORGE N. STEWART (*J. Physiol.*, 1899, **24**, 356—373).—The relative quantity of corpuscles and serum in defibrinated blood can be determined by adding to a definite quantity of the blood a known amount of a solution of hæmoglobin in the serum of the blood, centrifugating, and comparing the concentration of the hæmoglobin in the serum and in the original solution. The relation can also be determined by measuring the electrical conductivity of the blood and serum, and substituting the values in the formula $p = \lambda_{(b)}/\lambda s(180 - \lambda_{(b)} - \sqrt{\lambda_{(b)}})$, or in the formula $p = 174\lambda_{(b)} - (\lambda_{(b)})^2/\lambda(s)$, where $\lambda_{(b)}$ is the conductivity of the blood at $5° \times 10^8$, $\lambda(s)$ that of the serum, and p the number of c.c. of serum in 100 c.c. of blood. In the dog, p varies from 40 to 74. W. D. H.

Influence of Carbonic Anhydride and of Alkali respectively on the Anti-bacterial Properties of Blood and Similar Fluids. By HARTOG J. HAMBURGER (*Virchow's Archiv.*, 1899, **156**, 329—374).—If carbonic anhydride is allowed to act on blood, the bactericidal powers of the serum are increased; this is due to (1) the greater concentration of the serum, for, under the influence of the gas, the red corpuscles take up water; (2) the anti-bacterial power of the carbonic anhydride itself, and (3) the increase in the serum of diffusible alkali; this comes partly from the corpuscles, partly from the albuminates of the serum. For similar reasons, the serum of normal venous blood is more bactericidal than that from arterial blood. The blood from positions of venous congestion, œdema fluid, and exudations containing numerous cells (like 'laudable pus'), possess increased anti-bacterial power. W. D. H.

Physiological Relationships of Lactose, especially on the Intestine. By ERNST WEINLAND (*Zeit. Biol.*, 1899, **38**, 16—62).—In sucking animals (including the new-born child), there is in the small intestine a ferment, *lactase*, which is soluble in water, and capable of hydrolysing milk sugar. This is present also in the full-grown dog, pig, and horse, but not in the full-grown ox, sheep, rabbit, and hen. In the case of the calf, 22—23 grams of lactose were inverted in a digestion lasting $4\frac{3}{4}$ hours at 39°. After several months feeding on milk, the rabbit, and even the hen, develop the ferment in their intestine. In the dog, feeding on milk sugar does not increase the glycogen in the liver; a rise of the respiratory quotient is attributed to the bacterial decomposition of the sugar in the intestine.
W. D. H.

Influence of Inanition on the Glycogen in the Animal Body. By EDUARD PFLÜGER (*Pflüger's Archiv.*, 1899, **76**, 1—20).—The author's present experiments on hens, together with those of others quoted, show that the glycogen in the liver and in the muscles steadily sinks as inanition progresses. This is entirely at variance with C. Voit's idea that glycogen can increase from the splitting up of fat or proteid during the winter sleep of hibernating animals.
W. D. H.

Conversion of Nuclein Bases into Uric Acid by the Action of Oxygen on Tissue Extracts. By WILHELM SPITZER (*Pflüger's Archiv.*, 1899, **76**, 192—203).—By the digestion of extracts of liver and spleen at 40°, air being allowed to bubble through them and putrefaction being excluded, uric acid is formed; this is due to the oxidation of xanthine, hypoxanthine, and, to a less extent, of adenine and guanine. This confirms Horbaczewski's previous work.
W. D. H.

Chemical Stimulation of Nerve-containing and Nerve-less (Curarised) Skeletal Muscles. By G. ZENNECK (*Pflüger's Archiv.*, 1899, **76**, 21—58).—Curarised muscles in the frog contract more strongly to chemical stimuli (ammonia, ether, chloroform) than muscles which contain nerves. Solutions which stimulate motor nerves work more vigorously on nerveless muscles. Attention is directed at some length to the graphic record of such contractions.
W. D. H.

Physiological Effects of Peptone. By WILLIAM H. THOMPSON (*J. Physiol.*, 1899, **24**, 374—409. Compare Abstr., 1897, ii, 60).—Amphopeptone retards, antipeptone hastens, coagulation; with proteoses, both phases are obtained. All the ingredients of Witte's peptone, except antipeptone, possess vaso-dilating powers; the increasing order of potency is amphopeptone, deuteroproteose, heteroproteose, and protoproteose; this is due to a direct effect on the walls of the vessels. Tracings are given which show this effect on the intestinal, and to a less extent on the renal vessels.
W. D. H.

[Physiological Action of] Aspirin (Acetylsalicylic Acid). By Heinrich Dreser (*Pflüger's Archiv.*, 1899, **76**, 306—318).—It is essential that, if salicylic preparations are to be of any medicinal value, they must be in such a form that salicylic acid is liberated as soon as possible after absorption. The unpleasant taste of sodium salicylate has led to the introduction of numerous salicyl compounds, in many of which an alkyl group has been introduced. The present paper suggests an acetyl group is better, and specially praises acetylsalicylic acid, for which the name *aspirin* is suggested. It is easily split up by the gastric juice, or after absorption in the alkaline fluids of the body; its action on the nervous system is not so irregular as that of sodium salicylate, and, moreover, it stimulates the heart instead of depressing it as the sodium salt does. W. D. H.

Physiological and Toxicological Study of Ivy and Hederin. By Albert Joanin (*Compt. rend.*, 1899, **128**, 1476—1478).—On cold-blooded animals, hederin has not a very strong toxic action, 5 milligrams being required to kill a frog of from 35 to 40 grams weight; a slow and progressive paralysis sets in, death occurring after 24 or 30 hours. With warm-blooded animals, the action is more intense, the doses necessary to produce death being 5 to 7, 3 to 4, or 2 to 3 centigrams per kilogram of body weight, according as the injection is hypodermic, intraperitoneal, or intravenous. In all three cases, the symptoms are prostration, shivering, hypothermy often very accentuated, flatulence, diarrhœa sometimes sanguineous, coma, and death. When injected into a dog's stomach, hederin causes abundant vomitings and has also a very pronounced purgative action. Hederin causes a lowering of the arterial pressure which is transitory for small doses, but with large doses the decrease of pressure increases until death occurs. Hederin is hence an emeto-cathartic, and to its presence ivy owes its emetic and purgative effects; the nervous symptoms caused by ivy are probably due to some other principle. T. H. P.

Toxic Action of Sodium Fluoride. By Herbert B. Baldwin (*J. Amer. Chem. Soc.*, 1899, **21**, 517—522).—Sodium fluoride, taken in doses varying from about 0·25 to 9 grams, produces nausea, vomiting, and salivation, also frequently diarrhœa, the effects varying in intensity, of course, with the constitution of the individual. In one case, where a man accidentally took at least 10 grams, death ensued within 24 hours. In cases of suspected poisoning, the urine may be advantageously tested for fluorine. Sodium fluoride ought to be included as a second-class poison in works on toxicology.

L. de K.

Chemistry of Vegetable Physiology and Agriculture.

Alcoholic Fermentation without Yeast Cells. IX. By EDUARD BUCHNER and RUDOLF RAPP (*Ber.*, 1899, **32**, 2086—2094. Compare this vol., ii, 236).—As the result of numerous experiments, the following conclusions are drawn:

1. When yeast which has been well triturated with kieselgühr and quartz sand is fractionally filtered under a pressure of 60 kilos. per square cm., the liquid which runs through first is far less active than the later fractions, the most active portion being obtained by a second trituration and filtration without the addition of more water. From 1200 grams of yeast, with the gradual addition of 65 c.c. of water, 730 c.c. of active extract may be obtained. When, however, the extract is filtered through biscuit porcelain, the first 20 c.c. are much more active than any of the subsequent fractions.

2. Fermentation takes place equally readily with solutions of sugar containing from 15 up to 30 per cent. of sugar; in each case, toluene is added, and the temperature kept at 23°. When sugar is not present, very little fermentation takes place, the maximum amount of carbonic anhydride evolved from 20 c.c. of extract being after 40 hours 0·06 gram, and after 88 hours 0·1 gram.

3. Starch itself is not fermented by the extract, but "soluble starch" and dextrins of various origins are readily fermented (compare Abstr., 1898, i, 396).

4. Glucose and fructose are fermented at practically the same rate as one another, both by yeast extract and by fresh Munich bottom yeast. This conclusion, however, is not in accord with statements made by other authorities (compare Duclaux, Prior, and Kayser).

5. The previous irregularities (Abstr., 1898, i, 396 and 480) noticed on the addition of potassium arsenite to the yeast extract, are probably to be explained by the proteids in the extract protecting the zymase from the action of the arsenite, as it has been found that the dilution of the extract with water, in the presence of 2 per cent. of arsenite, practically stops fermentation, whereas dilution with blood serum or liquids rich in proteids, or even sugar solution, in the presence of the same amount of arsenite, retards the fermentation to a slight extent only. Glucose can also be fermented to a certain extent by yeast extract in the presence of arsenite. J. J. S.

Formation of Glycogen in Yeast Extract. By MAX CREMER (*Ber.*, 1899, **32**, 2062—2064).—The extract obtained from fresh yeast gives the usual glycogen reactions, but these are no longer shown when the extract has been kept for some 6—12 hours. If, however, those extracts which give little or no glycogen reaction are mixed with 10 per cent. or stronger solutions of fermentable sugars and then investigated at the end of 12—24 hours, it is found that, in most cases, the presence of glycogen can be again detected. Fresh yeast and a temperature of 10—12° appear to be the necessary factors. The newly-formed glycogen exhibits less opalescence than that originally present. The bearing of this discovery on the theory of the reactions in yeast extract is given. J. J. S.

Decomposition of Cement under the Influence of Bacteria. By GEORG BARTH (*Zeit. angew. Chem.*, 1899, 489).—In reference to Stutzer and Hartleb's work on this subject (this vol., ii, 505), it is stated that the decomposition of cement may take place in a comparatively short time. In one particular case, the cement crumbled after the water reservoir had been in use for only three years. The following analyses show that a large proportion of the lime had been washed out:

	SiO_2.	Al_2O_3.	Fe_2O_3.	CaO.	MgO.
Original Portland cement...	20·0	7·5	3·5	63·0	2·0
Disintegrated cement	33·21	21·84	10·94	24·23	9·36

L. DE K.

Physiological Significance of Alcohol in the Vegetable Kingdom. By P. MAZÉ (*Compt. rend.*, 1899, **128**, 1608—1610).—When peas are placed in contact with water, they gradually diminish in weight and in the water relatively large quantities of alcohol are found. Thus 100 peas in 100 c.c. of water at 22—23° yielded 4·63 per cent. of their weight of alcohol in 4 days and 10·54 per cent. in 13 days; starch and small quantities of reducing sugars were also found in the water. Peas from which the embryos have been removed give a similar production of alcohol and also a distinct odour of aldehydes. Alcohol thus appears to be a normal and necessary product of the digestion of the carbohydrates of peas during development and it is probably formed at the expense of the glucoses in the living cells by a diastatic process. T. H. P.

Lability and Energy in Relation to Protoplasm. By OSCAR LOEW (*Imp. Univ. Coll. of Agric. Tokyo, Bul.*, 1897, **2**, 393—405. Compare "The Energy of Living Protoplasm," London, 1896).—Albumin is produced by the condensation of the hypothetical aspartaldehyde which is formed in plant cells either from asparagine or from formaldehyde and ammonia. The albumin of living protoplasm differs chemically from that of dead protoplasm. Plants frequently contain, as reserve material, a highly labile aldehydic form of albumin. The chemical nature of this substance is altered by the same influences as those by which the protoplasm is killed. It is believed that active albumin gives rise to living matter.

The lability of the albumin of living protoplasm is due to the presence of aldehyde and amido-groups.

The conversion of the albumin of living into that of dead protoplasm presents a remarkable analogy to the transformation of an unstable substance into a stable modification. N. H. J. M.

The Causes of the Transformation of Sap-wood into Wood in Oaks (Quercus Robur and Q. Pedunculata). By ÉMILE MER (*Ann. Agron.*, 1899, **25**, 281—289).—During the change of sap-wood into wood, the reserve of starch is partly resorbed and an abundant production of tannin takes place. The latter, being unable to spread to any extent in the duramen already formed, remains in the radial and woody cells.

When dead wood is in contact with live wood, there is, as a rule, a migration of tannin, and, in the case of conifers, of resin from the latter; starch, however, does not penetrate into the dying wood. The migration of tannin is due to evaporation in the dead wood.

The following observations were made after a ring of bark was removed from the trunk of an oak. At first there was an accumulation of starch; subsequently, as the outside decayed, the amount of tannin increased.

The tannin in fully-developed wood is produced from the starch present in the same layer, from a part of the starch present in the younger woody rings, and from the starch which is resorbed in the sap-wood. N. H. J. M.

Commercial Varieties of Maté. By EDUARD POLENSKE and WALTER BUSSE (*Chem. Centr.*, 1899, i, 442; from *Arb. Kais. Ges.-A*, **15**, 171—177).—Four samples of maté from Brazil were examined: (1) finely-divided side-portions, mostly young leaves; (2) coarsely-ground sample, containing old leaves; (3) the same with numerous mid-ribs and stalks; (4) a sample containing 50 per cent. of very roughly-ground stems and stalks. The percentage composition is as follows:

							In ash.	
	Water.	Extract.	Tannin.	Soluble organic matter (excl. tannin).	Caffein.	Ash.	Mn_3O_4.	Fe_2O_3&Al_2O_3.
1.	6·79	36·66	9·59	22·25	0·88	6·00	5·51	4·03
2.	6·78	35·63	8·87	22·17	0·71	6·02	6·45	4·21
3.	6·98	34·13	8·10	21·83	0·53	5·44	5·90	3·00
4.	7·26	30·56	6·68	19·93	0·50	5·66	4·51	3·47

N. H. J. M.

Oil of Maize. By CYRIL G. HOPKINS (*J. Amer. Chem. Soc.*, 1898, **20**, 948—961).—This fat, which belongs to the drying oils, has the following composition: Cholesterol, 1·37; lecithin, 1·49; stearin (?), 3·66; olein, 44·85; linolein, 48·19; total, 99·56 per cent. It has a sp. gr. varying from 0·9245 to 0·9258, and solidifies at about −36°. When the temperature is gradually raised, it becomes transparent at −14°, but does not actually fuse below −2·4°. L. DE K.

Employment of Mangel Wurzels in Cattle Feeding. By L. BRÉTIGNIÈRE and DUPONT (*Ann. Agron.*, 1899, **25**, 257—281).—Sheep-feeding experiments were made with three varieties of mangolds, (1) tankard, (2) a rich variety, and (3) an intermediate variety, the average weight (in grams) and the composition of which was as follows:

				Per cent. in dry matter.				
	Av. wt.	Dry matter.	Sugar.	Organic N.	Nitric N.	Cellulose.	Ether extract.	Ash.
1.	1446	15·7	56·0	1·63	0·157	4·5	0·08	6·54
2.	454	22·3	70·1	1·10	0·030	5·2	0·3	4·0
3.	614	18·0	62·7	1·39	0·138	4·3	0·3	5·26

The juice contained (1) 9·4, (2) 16·6, (3) 12·1 per cent. of sugar, and the sugar in the roots amounted to (1) 8·8, (2) 15·6, and (3) 11·3 per cent. The yield of roots was 45830, 37000, and 44660 kilograms per hectare. The amounts of roots given in the daily rations were in proportion to the yield per hectare, being obtained in each case from an equal area of ground.

The results showed that the third variety (intermediate) gave the greatest increase in live weight, and the tankard much the least. The better results obtained with the intermediate as compared with the rich variety, is due to its greater digestibility. In a more suitable ration, the rich variety would have been better utilised, and its inferiority is attributed to the nutritive ratio of the mixed food having been too wide. N. H. J. M.

Employment of Maize Cake for Feeding Cows. By B. Schulle (*Ann. Agron.*, 1899, **25**, 300; from *Fühling's Landw. Zeit.*, 1898, ii, 12).—Maize cake has the following percentage composition:

Water.	Proteids.	Fat.	N-free extract.	Fibre.	Ash.
10·28	19·5—26·9	8·1—16·2	39·0—43·1	10·26	2·37

Twelve cows were fed for three periods of twenty days each with rations containing (1) no maize cake, (2) 2 lbs., and (3) 4 lbs. of cake. The effect of cake was to slightly increase the yield of milk, but there was a decrease in the percentage and in the yield of milk fat. The cows, however, increased in weight under the influence of maize cake. N. H. J. M.

Effect of the Amount of Water in the Soil on the Amounts of Nitrogen and Ash in the Dry Matter of Plants. By J. Wilms and Conrad von Seelhorst (*Chem. Centr.*, 1899, i, 444—445; from *J. Landw.*, 1898, **46**, 413—426. Compare this vol., ii, 508).—The effect of water is greatest the more fertile the soil. Increased supply of water does not increase the yield of straw much more than of grain, and diminishes the percentage of nitrogen equally in grain and straw. Nitrogenous manure, with abundance of water, does not increase straw production exclusively, whilst excess of potash increases the straw and diminishes the amount of grain. The amount of ash and of potash in grain is increased when the water in the soil is increased, but after a certain point is reached, further addition of water has very little effect. The amounts of ash and potash in straw are also to some extent altered by the amount of water present in the soil. In the case of phosphoric acid, the variation in amount (both in grain and in straw) under the influence of varying amounts of soil-water is much less than is the case with potash; the phosphoric acid in the grain is first increased, then diminished slightly, whilst in straw there is generally an increase as the amount of soil-water increases. The manuring has considerable effect on the percentage of phosphoric acid in straw; in the grain, the amount of phosphoric acid is only higher when the yield of grain is diminished by a deficiency of any constituent (including phosphoric acid itself). N. H. J. M.

Dissemination of Ferments in the Soil. By Pierre P. Dehérain (*Ann. Agron.*, 1899, **25**, 289—293).—Vetches were grown in large pots containing different soils differently manured. The amounts of dry produce in grams (mean of two pots) were as follows :—

Vetch soil.		Vine soil.		
No manure.	Superphosphate.	No manure.	Superphosphate.	Dung.
56·0	63·8	74·5	78·5	89·5

The vine soil was therefore better than vetch soil. Superphosphate had very little effect, whilst farmyard manure gave a considerably increased yield. All the plants had root nodules, although the vine soil had not grown leguminous plants for twenty-four years.

The author believes that soil inoculation with nitragin or with alinit is unnecessary, since the microbes are usually already present in the soil. What is wanted is, not to increase the number of microbes, but to furnish conditions suitable to both plants and bacteria.

N. H. J. M.

Phosphates [as Manures]. By JULES JOFFRE (*Bull. Soc. Chim.*, 1899, [iii], 21, 511—513).—The author has shown that apatite is far less soluble than tricalcium phosphate. He has made comparative experiments on mustard plants, using different phosphates as manures. Apatite has hardly any action, tricalcium phosphate has a decided effect, whilst monocalcium phosphate, being soluble in water, has a much greater effect.

R. H. P.

Analytical Chemistry.

Use of a Centrifugal Machine to Collect Precipitates in Quantitative Analysis. By G. MEILLÈRE (*Bull. Soc. Chim.*, 1899, [iii], 21, 513—515).—The author recommends the use of a centrifugal machine in many quantitative operations where heavy precipitates are manipulated. It is shown that this method has many advantages, amongst others that very little liquid is required to wash the precipitates, that the danger of atmospheric oxidation is lessened, and that the calcination of the filter paper is avoided as the precipitates are weighed in the tube of the centrifugal machine.

R. H. P.

Standardisation of Volumetric Acid and Alkali. By WILLIAM A. PUCKNER (*Pharm. Arch.*, 1898, 1, 172—184).—The investigation deals with the standardising of acids and alkalis with sufficient accuracy for pharmaceutical purposes.

Crystallised oxalic acid is not always of constant composition, and should be avoided. Sulphuric acid is recommended, its strength being ascertained by converting it into ammonium sulphate and weighing, as suggested by Weinig (Abstr., 1893, ii, 145). This process has been variously criticised; the author, however, finds that it gives excellent results if conducted as follows: 10 c.c. of the approximately correct acid are measured into a wide, flat-bottomed weighing bottle and weighed; the stopper is removed and 2 c.c. of strong ammonia free from residue are added; the whole is evaporated on a steam bath, the flask being rotated occasionally towards the end of the operation to avoid the formation of a crust which interferes with the drying; the residue is then finally dried to constant weight in a drying oven kept at a temperature of 65—80°; no loss of ammonia need then be feared.

Mineral acids may be standardised with borax, using methyl-orange as indicator. This substance being of high molecular weight is useful to those who have not a very delicate balance at their disposal, but the chief drawback is that the change in colour at the finish of the titration is not quite plain. Sodium carbonate is much more convenient if prepared as follows: 20 grams of pure sodium hydrogen carbonate are heated in a porcelain dish for 10 minutes over the full flame of a bunsen burner, the mass being well stirred so as to insure uniform heating; the partially cooled substance is then transferred to weighing tubes so that each shall contain 1·5—2·0 grams of the carbonate. When cold, the stopper is for a second removed, then reinserted and the tube weighed; the contents are emptied into a beaker and the tube is reweighed. L. DE K.

Detection Estimation of Small Quantities of Chlorine in Presence of Large Quantities of Bromine. By HENRI BAUBIGNY (*Compt. rend.*, 1899, **128**, 1326—1329).—About 6 grams of the potassium bromide to be examined are dissolved, together with 18 grams of crystallised cupric sulphate, in 110—120 c.c. of water, and 2·5 grams of potassium permanganate are added. The bromine liberated at the ordinary temperature is carried away by means of a current of air, and the liquid is gradually heated to 100° on a water-bath. After 10 minutes at this temperature, all odour of bromine has disappeared; 0·5 gram of permanganate is added to complete the oxidation, and the liquid heated until the vapour no longer reacts with fluorescein paper, care being taken, however, that the volume of the liquid is not reduced below 50 to 55 c.c. The chlorine in the residual liquid is precipitated in the usual way. Even the purest potassium bromide commercially obtainable contains 0·01 per cent. of chlorine (compare Abstr., 1898, ii, 137, and this vol., ii, 244 and 328). C. H. B.

Separation and Estimation of Chlorine, Bromine, and Iodine in Halogen Salts. By RICHARD JOS. MEYER (*Zeit. anorg. Chem.*, 1899, **21**, 79—83).—An answer to Gooch and Browning's criticism (*Amer. J. Sci.*, 1890, [iii], **39**, 188). E. C. R.

Estimation of Sulphuric Acid in the presence of Iron. By FRIEDRICH W. KÜSTER and A. THIEL (*Zeit. anorg. Chem.*, 1899, **21**, 73—78).—An answer to Lunge's criticism on the authors' method. (See this vol., ii, 247 and 329). E. C. R.

Some Errors in the Estimation of Nitrogen. By CYRIL G. HOPKINS (*J. Amer. Chem. Soc.*, 1898, **20**, 961—965).—When estimating nitrogen as ammonia, two slight sources of error may occur. Loss of ammonia may take place when the delivery tube does not dip far enough into the standard acid; this may be prevented by using tubes reaching quite to the bottom of the receiving flasks and contracted at the end to an aperture of 4 or 5 mm. diameter. Another source of error is caused by using standard ammonia and titrating in an open vessel, as the drops of liquid lose ammonia by evaporation before reaching the acid; this can be prevented by titrating in an Erlenmeyer flask attached to the burette by means of a rubber stopper provided with a capillary tube for relieving pressure.

L. DE K.

Estimation of Hydrogen Phosphide in Mixtures of Gases. By ALEXANDRE JOANNIS (*Compt. rend.*, 1899, **128**, 1322—1325).—When hydrogen phosphide is brought in contact with a solution of cupric sulphate in such proportion that not more than 2 mols. of the sulphate are present for every 2 mols. of the gas, the absorption is at first slow, but afterwards becomes more rapid, and 1·5 mols. of the gas are absorbed for every 2 mols. of cupric sulphate present. Very soon, however, pure hydrogen phosphide is given off from the solution, and ultimately only 1 mol. of the gas is retained by every 2 mols. of the sulphate. If a further quantity of the copper salt is added at this stage, or if it is used in excess at first, the hydrogen phosphide is completely absorbed.

The cupric sulphate solution does not absorb nitrogen, hydrogen, methane, nitrous oxide, or nitric oxide, and they do not affect the absorption of the hydrogen phosphide. On the other hand, oxygen, carbonic oxide, and acetylene, if present, are absorbed in somewhat large quantity, doubtless because of their action on the cuprous salt that is formed by the reducing action of the hydrogen phosphide. Ethylene is similarly absorbed, but more slowly, and in smaller quantity.

It follows that hydrogen phosphide in mixtures of gases can only be estimated accurately by means of cupric sulphate solution in the absence of gases that have any action on cuprous salts, and in all cases it is essential to employ a higher proportion of the sulphate than 2 mols. for each molecule of hydrogen phosphide present. C. H. B.

Estimation of Hydrogen Phosphide in Gaseous Mixtures. By JOSEPH RIBAN (*Compt. rend.*, 1899, **128**, 1452—1453).—With regard to Joannis's statement (preceding abstract) that, as an absorbent for hydrogen phosphide, copper sulphate solution is to be preferred to a hydrochloric acid solution of cuprous chloride, the author points out that the latter, when freshly prepared and colourless, does not attack mercury; cuprous chloride solution, when darkened by oxidation, may be readily decolorised by shaking with a little mercury. Further, copper sulphate solution, when used to dissolve hydrogen phosphide in a gaseous mixture, precipitates black, flocculent copper phosphide, from which it is difficult to separate the gaseous residue with accuracy.

T. H. P.

Estimation of Calcium and Magnesium in Ashes. By JOHN K. HAYWOOD (*J. Amer. Chem. Soc.*, 1899, **21**, 508—511).—The usual process is to add an excess of ferric chloride and then to remove the phosphoric acid and the iron by boiling with ammonium acetate. The precipitate is, however, very bulky, and difficult to wash, and it also not unfrequently runs through the filter.

The author states that the washing may be entirely dispensed with by precipitating the iron in a 500 c.c. flask; when cold, water is added to the mark, and the mixture is well shaken, 250 c.c. are then filtered through a dry filter and the trace of iron which has redissolved is precipitated with a little ammonia; traces of manganese may be removed by adding more ammonia and some bromine. The filtrate then contains the calcium and magnesium.

This process does not give a correction for the volume of the ferric precipitate, but the author has proved that the accuracy of the result is not influenced by the volume of the precipitate unless it is inordinately large, which is rarely the case in practice. L. DE K.

Quantitative Separation of Cerium. By GRÉGOIRE N. WYROUBOFF and AUGUSTE VERNEUIL (*Compt. rend.*, 1899, **128**, 1331—1334).—The method is based on the fact that cerosoceric oxide readily polymerises when heated with nitric acid, and that the sulphate $4Ce_3O_4,2H_2SO_4$ is quite insoluble in water. Difficulties are caused by the fact that the other monoxides can replace cerous oxide; moreover, it is not easy to completely convert the cerium into the cerosoceric oxide.

If the mixture of oxides contains more than 50 per cent. of cerosoceric oxide, it is dissolved in nitric acid to which successive small quantities of hydrogen peroxide are added. The concentrated solution of the nitrates is precipitated by ammonia and hydrogen peroxide, evaporated on a water-bath, and heated over a direct flame until ammonium nitrate begins to volatilise. The residue is dissolved in nitric acid, concentrated to a syrup, dissolved in water, heated to boiling, mixed with a small quantity of a 5 per cent. solution of ammonium sulphate, and the precipitate collected and converted into oxide by heating it at a white heat. The filtrate is mixed with ammonium persulphate and sodium acetate, and boiled, any further precipitate being treated as before.

If the mixture of oxides contains less than 50 per cent. of cerium, it is dissolved at once in nitric acid, evaporated to a syrup, and treated with the ammonium sulphate solution.

If the amount of cerium does not exceed 10 or 15 per cent., the first part of the operation may be omitted, and the nitric acid solution may be treated at once with ammonium persulphate and sodium acetate. C. H. B.

Estimation of Iron in the Ferric State by Reduction with Sodium Thiosulphate and Titration with Iodine. By JOHN T. NORTON (*Amer. J. Sci.*, 1899, **8**, 25—30).—Attempts to estimate ferric salts by reduction with thiosulphate have already been made with varying success by Sherer, by Mohr, by Kremer and Landolt, and by Oudemans, who recommended the addition of a small quantity of copper sulphate; this process has been again modified by Haswell and also by Bruel.

The author, finding none of these processes to work satisfactorily, has carefully studied the reactions between ferric iron, free acid, and sodium thiosulphate, and now recommends the following process. It is, however, only by exactly carrying out the instructions that very accurate results may be obtained.

An amount of ferric oxide not exceeding 0·2 gram is dissolved in hydrochloric acid and evaporated to a pasty mass. This is then dissolved in 800 c.c. of freshly boiled water, and, after adding a drop of solution of potassium thiocyanate, 50 c.c. of *N*/10 sodium thiosulphate are added and the liquid left until perfectly colourless; the excess of thiosulphate is then estimated as usual by means of *N*/10 iodine with starch as indicator. If it is preferred to work on a larger quantity of iron, which must, however, not exceed 0·4 gram, the amounts of water and thiosulphate must be increased in due proportion. L. DE K.

Syphon Arrangement for Reduction Flasks. By HEINRICH GÖCKEL (*Zeit. angew. Chem.*, 1899, 620—621).—The apparatus is intended to prevent reoxidation of iron after a ferric salt has been reduced by means of nascent hydrogen.

The flask containing the ferric compound which is being reduced with metallic zinc is fitted with a cork through which passes a straight tube, the top of which is sealed to a narrow syphon whose longer limb dips into a solution of sodium hydrogen carbonate contained in a bulb which encircles and is sealed to the large tube.

When action has ceased, a little of the soda solution is drawn into the flask, but the excess of acid at once liberates carbonic anhydride which prevents more liquid from entering. The apparatus may now be left for a considerable time before the iron need be titrated.

L. DE K.

Colorimetric Estimation of Nickel. By MAURICE LUCAS (*Bull. Soc. Chim.*, 1899, [iii], 21, 432—433).—For the rapid approximate estimation of nickel in steel, the author makes use of the red coloration produced in alkaline or neutral solutions of nickel by potassium or ammonium thiocarbonate, a large excess of which must be added to obtain a uniform and persistent coloration. As copper and cobalt solutions also give colorations with thiocarbonates, these metals must be removed; the presence of cobalt is readily detected by the fact that the colour produced by ammonium thiocarbonate with cobalt salts is much darker than that obtained with the potassium salt. The process is carried out as follows: a graduated scale of tints is made by preparing a number of solutions of equal volumes containing equal quantities of the thiocarbonate to which have been added known and increasing proportions of nickel and about equal proportions of ammonium salts. 0·5 gram of the steel is then dissolved in nitrohydrochloric acid and the iron separated by two successive precipitations with ammonium chloride and ammonia solution; the liquid is then diluted to 500 c.c. Two separate quantities of 50 c.c. are taken and to one 10 c.c. of ammonium thiocarbonate solution are added, and to the other 10 c.c. of the solution of the potassium salt. If the former is much darker than the latter, cobalt is present and must be removed; but if not, the liquid is compared with the series of liquids containing known quantities of nickel. T. H. P.

Qualitative Separation of Antimony and Tin. By G. BORNEMANN (*Zeit. angew. Chem.*, 1899, 635—636).—The process is based on the insolubility of stannic phosphate in nitric acid, the antimony compound being readily soluble. The solution which must contain the tin and the antimony as perchlorides, and is, if necessary, heated with a little potassium chlorate, is mixed with a drop of solution of litmus or phenolphthalein, and aqueous caustic soda is added until a clear, strongly alkaline liquid is obtained; if tin is present, the precipitate redissolves but imperfectly unless heat is applied. After adding an excess of solution of disodium hydrogen phosphate, nitric acid is added in very slight excess and the mixture boiled. If a precipitate does not form, the liquid must be diluted and again boiled; the complete absence of any precipitate shows the absence of tin. In the presence of tin, a heavy precipitate of stannic phosphate is formed which, however, always occludes a trace of antimony and is, moreover, of varying composition; the filtrate contains nothing but antimony, which may then be proved by treatment with hydrogen sulphide.

L. DE K.

Separation of Metals by Means of Hydrogen Bromide. By ELIZABETH A. ATKINSON (*J. Amer. Chem. Soc.*, 1898, **20**, 797—810).—Hydrogen chloride having been successfully employed by Moyer as a means of separating metallic oxides (Abstr., 1897, ii, 434), the author has tried whether hydrogen bromide may be used instead with advantage.

The gas is readily prepared by dropping bromine from a separating funnel, at the rate of five drops a minute, upon anthracene contained in a flask placed in nearly boiling water. To purify the gas, it is passed first through a tube containing anthracene and then through one containing calcium chloride. The substance to be acted on is placed in a porcelain boat, which is then put inside a combustion tube connected with the receiver by a bent tube provided with a stopcock to avoid danger of backward suction. The volatile substances are collected in water except in the case of arsenic, where it is better to use dilute nitric acid. The heat may be obtained from three fish-tail burners.

The results obtained show that hydrogen bromide is a convenient reagent for quantitatively separating arsenic, bismuth, and antimony from metals the bromides of which are not readily volatile, such as copper, lead, cobalt, silver, and cadmium, but the separation of arsenic from iron is not satisfactory. The non-volatile bromides obtained are not always pure, as the lead compound has approximately the formula $PbO,5PbBr_2$, and cobalt also forms an oxybromide, whilst copper yields cuprous bromide. The chlorides of antimony and bismuth require from 6 to 8 hours for their complete expulsion, but antimony bromide volatilises completely in $1\frac{1}{2}$ hours, and bismuth bromide requires $2\frac{1}{2}$ hours; arsenic chloride and bromide are both expelled in $1\frac{1}{2}$ hours.

L. DE K.

Measurements of Turbidity in Water. By WILLIAM P. MASON (*J. Amer. Chem. Soc.*, 1899, **21**, 516—517).—The sample is examined in a brass tube $2\frac{1}{2}$ inches in diameter and 2 feet long, closed at the ends by discs of $\frac{1}{4}$ inch plate-glass held in place by screw caps. In a similar tube, distilled water is placed to which is then added an emulsion of very finely divided kaolin (1—1000) until the turbidity is the same as in the other. The turbidity may then be stated in parts per million.

Any material which subsides quickly should not be classed as turbidity, but as sediment, and should be collected and weighed.

L. DE K.

Detection of Rare Metals in Mineral Waters. By F. GARRIGOU (*Compt. rend.*, 1899, **128**, 1587—1588).—The author finds that many mineral waters contain appreciable quantities of salts of the metals of the tin and iron groups, although these are not in general estimated. His method of detecting them is to calcine in a test-tube the residue obtained by evaporating two litres of the water. The mass is then boiled with hydrochloric acid, the liquor evaporated to dryness and to the cold residue dilute hydrochloric acid and hydrogen sulphide solution are added; if a darkening or coloration takes place, metals of the tin or copper group are present. If darkening only occurs on adding ammonia and ammonium sulphide solutions, metals of the iron group are indicated; the formation of a white turbidity, but no darkening, shows the presence of metals of the aluminium group, phosphates, borates, &c.

T. H. P.

Estimation of Ferrocyanides and Carbonylferrocyanides and their Separation. By JOSEPH AUGUSTE MULLER (*Bull. Soc. Chim.*, 1899, [iii], **21**, 475—477).—A solution of ferrocyanide containing 4 to 5 grams per litre, is made slightly acid with nitric or acetic acid, a solution of lead nitrate or acetate added, and the precipitate formed after remaining for 12 hours filtered and dried; this is digested with sulphuric acid and then weighed. The weight of the mixture of lead sulphate and ferric oxide multiplied by 0·5378 gives the weight (as potassium ferrocyanide) of the ferrocyanide taken.

Carbonylferrocyanides are precipitated in a similar manner with copper acetate, the precipitate being ignited with sulphuric acid, and the copper in the residue estimated by Rose's method as cuprous sulphide. The weight of cuprous sulphide multiplied by 2·787 gives the corresponding weight of potassium carbonylferrocyanide.

The separation of these compounds is based on the fact that carbonylferrocyanides are not precipitated in acid solution by lead acetate, whilst the precipitation of ferrocyanides is quantitative. Any carbonylferrocyanide carried down in the precipitate is eliminated by solution in caustic soda and subsequent reprecipitation with dilute acetic acid. The carbonylferrocyanide is then estimated by precipitation with copper acetate.

R. H. P.

Estimation of Sugars by Weighing the Copper Precipitate. By G. MEILLÈRE and PH. CHAPPELLE (*Bull. Soc. Chim.*, 1899, [iii], **21**, 515).—The reduction of the Fehling's solution is carried out in a tube of the centrifugal machine (this vol., ii, 610). The tube is heated in brine and centrifugated. After two washings, the tube is heated for 5 minutes at 150°, cooled, and then weighed. The result can be controlled by reducing the cuprous oxide in the same tube by a current of hydrogen. Some kinds of glass are in this procedure attacked by the alkaline liquids ; it is therefore advisable to weigh the tube before and after the estimation. R. H. P.

Iodometric Estimation of Sugar by means of Fehling's Solution. By N. SCHOORL (*Zeit. angew. Chem.*, 1899, 633—635).—The process is a modification of the iodometric method of estimating the excess of copper left in the liquid after treatment with a reducing sugar, which was first proposed by Lehmann and improved by Riegler and also by Maquenne.

10 c.c. of Fehling's solution of copper sulphate are mixed in a 200 c.c. Erlenmeyer flask with 10 c.c. of Fehling-Soxhlet's alkaline solution of Rochelle salts, diluted with 50 c.c. of water, and boiled for 2 minutes. After cooling rapidly under a tap, 10 c.c. of a 20 per cent. solution of potassium iodide are first added, and then 10 c.c. of a 25 per cent. solution of sulphuric acid, the liberated iodine being then titrated without delay with $N/10$ sodium thiosulphate.

The experiment is then repeated after having first added a quantity of dextrose or invert sugar not exceeding 0·090 gram, or about 0·125 gram of lactose ; when dealing with the latter sugar, the time of boiling should be extended to 5 minutes, and the blank experiment conducted in the same way. The difference in the number of c.c. of thiosulphate used in the two experiments is the measure of the amount of sugar. A convenient table is given showing the relation between the thiosulphate and the lactose, dextrose, saccharose, and starch.

L. DE K.

Assay of Spirit of Nitrous Ether. By RICHARD FISCHER and J. A. ANDERSON (*Pharm. Arch.*, 1898, 1, 161—167, 169—172).—The authors have investigated the three principal methods in use for the assay of spirit of nitrous ether, U.S.P.

The gasometric, or Allen's, method is the most convenient, but to obtain correct results, due corrections must be made for pressure, vapour tension, and solubility of the nitric oxide in the brine ; these corrections are given in tables. An important fact is stated, namely, that the gas given off on mixing the sample with water or potassium iodide may consist principally of the vapour of ethylic nitrite ; even the gas given off in the nitrometer by treatment with potassium iodide and sulphuric acid often contains a considerable proportion of ethylic nitrite vapour ; as this, however, represents its own volume of nitrogen at an average temperature, it does not affect the experiment ; when cooled to zero, it practically disappears.

The process based on heating the sample with a small quantity of potassium hydroxide and afterwards titrating the nitrite formed by means of potassium iodide and sodium thiosulphate, gives untrustworthy results, but by using more alkali, and warming for at least 24 hours, good results may be obtained.

Curtman's process is also criticised. This consists in treating the sample with ferrous sulphate, expelling the nitric oxide by heating, and estimating by the iodometric method the ferric iron produced. The authors find this process to be quite valueless, but by operating in an atmosphere of carbonic anhydride, and extending the time of action from half-an-hour to 5 hours, or even some days, results may be obtained agreeing closely with those given by Allen's method. L. DE K.

Assay of Amylic Nitrite. By RICHARD FISCHER and J. A. ANDERSON (*Pharm. Arch.*, 1898, 1, 189—194).—The author recommends preparing amylic nitrite by following the directions of the U.S.P. For the purpose of testing, a 5 per cent. alcoholic solution may be prepared. The best and quickest results are obtained by the gasometric method (see preceding abstract) and special tables are given. The other processes as modified by the authors may also be used, but they take from 1 to 2 days. L. DE K.

Estimation of the Acidity of Tanning Liquors. By PAESSLER and SPANJER (*Zeit. angew. Chem.*, 1899, 636—638).—Twenty-five c.c. of the infusion is mixed in a beaker with 25 c.c. of a neutral solution of gelatin (2 : 1000, but if the material is rich in tannin, a stronger gelatin solution may be employed). Standardised baryta water is then added from a burette until the liquid shows neutrality when dropped on delicate litmus paper. The acidity is calculated as acetic acid. The accuracy of the process has been proved by testing mixtures of freshly prepared tannin infusions with known amounts of acetic or lactic acids ; the results were very satisfactory. L. DE K.

Estimation of added Water in Milk. By A. G. WOODMAN (*J. Amer. Chem. Soc.*, 1899, 21, 503—508).—The author's process is a slight modification of the method proposed by Radulesen, which is based on the fact that milk serum has a fairly constant specific gravity.

One hundred c.c. of the sample, which should be at a temperature of about 20°, are thoroughly mixed with 2 c.c. of dilute acetic acid of sp. gr. 1·035. The beaker containing the mixture is covered with a watch glass and heated for 20 minutes in a water-bath at 70°, when it is removed and at once placed in ice water, where it is kept for 10 or 15 minutes, and the liquid then passed through a dry folded filter. The filtrate, which should be clear, or but very slightly opalescent, is cooled to 15°, and the sp. gr. taken, say, with a Westphal balance; if the sample is pure this should not be less than 1·029 (according to Radulesen, 1·027 is the limit) and the percentage of added water may therefore be readily calculated from a deficiency in gravity. The average decrease in sp. gr. for each 10 per cent. of water is 0·0031.

L. DE K.

Action of Silver Nitrate on the Fatty Acids of Cotton Seed Oil. By EUGÈNE CHARABOT and MARCH (*Bull. Soc. Chim.*, 1899, [iii], 21, 552—554).—The fatty acids obtained by the hydrolysis of cotton seed oil and subsequent precipitation with a mineral acid contain sulphur compounds. Silver nitrate gives with these acids a brown precipitate of the silver salt of an acid (melting at 52°) mixed with silver sulphide. The reaction must be used with care to detect cotton seed oil in olive oil, as the latter, under similar conditions, gives a black precipitate of silver sulphide (Dupont, Abstr., 1896, i, 409).

R. H. P.

Estimation of Morphine in Opium. By CLEMENTE MONTEMARTINI and D. TRASCIATTI (*Gazzetta*, 1899, **29**, i, 292—300).—A discussion of various criticisms on the method given by the authors for the estimation of morphine in opium (Abstr., 1898, ii, 270).

T. H. P.

Estimation of Santonin. By JULIUS KATZ (*Arch. Pharm.*, 1899, **237**, 245—256).—Ten grams of the coarsely-powdered *Flores Cinæ*, are extracted with ether (*Pharm. Ger.*, III) for 2 hours in a Soxhlet apparatus. The ether is distilled off, and the residue is boiled for 1/4—1/2 hour in a reflux apparatus with a solution of 5·0 grams of crystallised barium hydroxide in 100 c.c. of water. The solution is allowed to cool, and is then saturated with carbonic anhydride, until it reddens blue litmus paper; it is then filtered at once, and washed twice, each time with about 20 c.c. of water. The filtrate is concentrated on the water-bath to a volume of about 20 c.c., mixed with 10 c.c. of dilute (12·5 per cent.) hydrochloric acid, warmed for 2 mins. more (no longer), allowed to cool, and poured into a separating funnel, any crystals of santonin that remain in the basin being rinsed into the funnel with about 20 c.c. of chloroform. The mixture in the funnel is then shaken well, and the chloroform solution is drawn off and filtered, dish, funnel, and filter being washed twice with about 20 c.c. of chloroform. The chloroform is then distilled off, and the residue boiled for 10 mins. in a reflux apparatus with 50 c.c. of 15 per cent. alcohol; the hot solution is filtered into a weighed flask, the apparatus employed being rinsed twice into the flask with 10 c.c. of boiling 15 per cent. alcohol, after which the flask is covered with a watch-glass and set aside for 24 hours. The flask is then weighed; the contents are filtered through a weighed filter of 9 cm. diameter (any milkiness in the filtrate, due to resinous matter, being neglected), and flask and filter are washed with 10 c.c. of 15 per cent. alcohol; the filter is dried in the flask, and the latter is weighed. For every 10 grams of the alcoholic filtrate, excluding the last 10 c.c., 0·006 gram must be added to the weight of santonin found, to correct for the solubility of the latter in the alcohol. In two test experiments 0·2640 and 0·2834 gram of santonin were obtained instead of 0·2770 and 0·2862 taken.

A modification of the above process may be introduced, owing to the fact that santonin only reacts with alcoholic potash at 80—90°, whereas the accompanying resin does so at the ordinary temperature. The solution in 15 per cent. alcohol is evaporated, the residue is dissolved in 20—30 c.c. of absolute alcohol, 3 drops of phenolphthalein are added, and then *N*/10 potash solution until the pink colour is permanent for 10 minutes. At this point, 20 c.c. of *N*/10 potash are added at once, the solution is heated to boiling, diluted with 50 c.c. of cold water, and titrated with *N*/10 hydrochloric acid. A blank experiment is performed to ascertain the effect of the glass on the potash. From the 20 c.c. are subtracted the volume of acid used, and of potash neutralised in the blank experiment, and the remainder is multiplied by 0·0246, which gives the weight of santonin present. In an experiment made to test the possibility of titrating santonin in alcoholic solution, 0·3100 gram were found instead of 0·3080 taken. In another experiment, 3·21 and 3·38 per cent. were found, as against 3·16 by the gravimetric method.

From pastilles that contain only sugar in addition, santonin can be obtained in a state of sufficient purity by simple extraction with chloroform. When chocolate also is present, the method described above must be followed, except that the chloroform solution may be simply evaporated to dryness (more easily if a little ether be added) and the residue weighed. Should a slight turbidity of the filtered barium santonate solution indicate the presence of traces of fatty acids, the crystals of santonin may be washed from these with 10—20 c.c. of light petroleum, in which they are almost insoluble.

In 10 samples of *Flores Cinæ* the percentage of santonin was found to range from 1·21 to 3·16; in the tincture prepared from these by percolation with five times their weight of 90 per cent. alcohol, it ranged from 0·212 to 0·628. C. F. B.

Testing Indigo: A Yellow Compound found in Java Indigo. By CHRISTOPHER RAWSON (*J. Soc. Chem. Ind.*, 1899, **18**, 251—252).—The usual plan of assaying indigo is to dissolve the sample in strong sulphuric acid; on adding water, the colouring matter remains in solution as indigotindisulphonic acid, and various impurities remain in suspension. Before titrating, it is necessary to remove these insoluble matters, but the filtration is very troublesome and part of the colouring matter is fixed by the paper. The use of paper may be avoided, as follows: 0·5 gram of the powdered sample, mixed with glass powder, is digested with 25 c.c. of pure, strong sulphuric acid at 70° for 1 hour. When cold, the liquid is diluted with water, mixed with 10 c.c. of a 20 per cent. solution of barium chloride, and diluted to 500 c.c. In about 20 minutes, the barium sulphate which carries down all the suspended matter will have settled, and an aliquot part of the clear solution may be drawn off with a pipette.

The presence of a yellow colouring matter, sometimes to the extent of 20 per cent., has recently been noticed in samples of Java indigo, and the presence of this substance interferes with the ordinary method of analysis, as it behaves in many respects like indigotin. It may be detected by adding aqueous soda or ammonia to powdered indigo placed in a porcelain basin, when the alkali will assume a deep yellow colour. It may be removed by boiling with dilute ammonia, or preferably with alcohol, which also dissolves any indirubin, and the insoluble matter is then sulphonated as usual and titrated for indigotin. The alcoholic or ethereal solutions are colourless, but turn yellow with alkalis. Indirubin may be estimated as follows: 0·1—0·25 gram of the sample is boiled with 150 c.c. of ether in a reflux apparatus; when cold, the liquid is made up to 200 c.c. and shaken with 10 c.c. of water; this causes the undissolved matter to settle completely. A measured quantity of the liquid is now withdrawn and compared in a colorimeter with a standard solution of indirubin. L. DE K.

General and Physical Chemistry.

Refraction of Pure Water and of Normal Salt Solutions.—I. Water.—By Carl Bender (*Ann. Phys. Chem.*, 1899, [ii], **68**, 343—349).—The refraction of water was determined at various temperatures by a Pulfrich's refractometer and three interpolation formulæ are given for the values of the refraction for H_α, H_β, and H_γ. The dispersion decreases only very slightly with rise of temperature, so that between 10° and 40° similar formulæ differing only in the first term may be used for the three lines—namely, $H_\alpha = 1{\cdot}3323004 - 0{\cdot}0001129\ (t^\circ/5) - 0{\cdot}0000419\ (t^\circ/5)^2$, the first terms for H_β and H_γ being respectively 1·3382118 and 1·3414389. The values for water containing dissolved air were found to agree with those of pure water within the limits of experimental error. L. M. J.

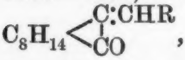
Changes of Silver Iodide in Light, and the Daguerreotype Process. By Hermann Scholl (*Ann. Phys. Chem.*, 1899, [ii], **68**, 149—182).—If a silvered glass is exposed to iodine vapour, it becomes covered with a clear deposit of silver iodide, which, on exposure to light, becomes cloudy. The author shows that this cloudiness is not due to any chemical change, but to a mechanical alteration of the illuminated layer; and the change further requires the catalytic action of some oxidising agent such as oxygen or iodine. If the silver iodide has an underlayer of silver, however, chemical action ensues and the silver becomes converted into iodide with reduction of the surface layers; this action is also accelerated by the catalytic action of the oxygen of the air. The capability of development of exposed Daguerreotype plates is due to this change and to the presence, in the surface layers, of the reduced silver; it extends also through the whole thickness and is throughout proportional to the light intensity at the surface. A layer of silver iodide was deposited between two platinised glass plates and connected electrically with a galvanometer, and when this was exposed to light an E.M.F. was produced the direction of which indicated a migration of iodine in the direction of the light rays. L. M. J.

Contributions to the Study of Optical Isomerism. By Paul Walden (*Chem. Centr.*, 1899, i, 327; from *J. Russ. Chem. Soc.*, 1898, **30**, 767—794).—A continuation of earlier work (compare this vol., ii, 393). This section deals with Guye's hypothesis. The author gives a general account of his own publications, and quotes Guye, Landolt, and Ostwald as supporting his conclusions. The theory of Le Bel and van't Hoff, that only a chemical difference in the four groups attached to the carbon atom is necessary for the production of asymmetry, is regarded as entirely confirmed. The following molecular rotations are given in the paper :—

l-Amylic propionate	$[M]_D + 3{\cdot}96°$
,, butyrate	4·43
,, bromacetate	5·75
,, bromopropionate	5·41
,, glycollate	3·67
,, α-hydroxybutyrate	4·82
,, α-hydroxyisobutyrate	5·06
l-Amylic oxalate	$[M]_D + 11{\cdot}78$
,, malonate	8·09
,, ethylmalonate	9·26
,, isoamylmalonate	9·98
,, glutarate	9·54
,, suberate	8·76
,, sebacate	9·18

J. C. P.

Molecular Refraction and Dispersion and Specific Rotation of Compounds of Camphor and Aromatic Aldehydes. By Albin Haller and Paul Th. Muller (*Compt. rend.*, 1899, **128**, 1370—1373).—The optical properties of compounds of the type



$C_8H_{14}<\begin{matrix}C{:}CHR\\ |\\ CO\end{matrix}$

, in which R represents radicles derived from benzaldehyde, cinnamaldehyde, piperonaldehyde, and the methoxybenzaldehydes, are summarised in the table :—

R.	Molecular Refraction.						Molecular dispersion.		Specific rotation.
	α.	Calculated (Brühl).	Na.	Calculated (Conrady).	β.	γ.	Found.	Calculated (Brühl).	
$\cdot Ph$	76·35	71·94	77·21	72·65	79·35	82·70	6·35	2·39	+425·11°
$\cdot C_6H_4<^{O}_{O}>CH_2$.	85·23	77·61	86·00	78·52	89·30	93·17	7·94	2·46	435·40
$\cdot C_6H_4Pr^{\beta}$	90·80	85·65	91·43	86·46	94·93	98·15	7·35	2·73	495·68
$\cdot C_6H_4\cdot OMe$ [1 : 2]	83·03	78·16	83·96	78·94	86·73	89·43	6·40	2·51	431·50
$\cdot C_6H_4\cdot OMe$ [1 : 3]	83·42	78·16	84·09	78·94	86·87	89·28	5·86	2·51	379·35
$\cdot C_6H_4\cdot OMe$ [1 : 4]	85·20	78·16	86·02	78·94	89·50	92·66	7·46	2·51	467·07

The calculated values (employing Brühl's and Conrady's coefficients as indicated in the table) are based on the assumption that the group $>C{:}CHR$ contains four double linkings, and the conclusion is drawn that the introduction of this radicle augments the molecular refraction and dispersion of camphor, and multiplies the value of its specific rotation by ten (compare Gladstone, Trans., 1891, 590).

G. T. M.

Dissipation of Electrostatic Charges by Light. By Oscar Knoblauch (*Zeit. physikal. Chem.*, 1899, **29**, 527—545).—Many negatively charged substances, when illuminated, gradually lose their charge, as may be shown by connecting them with an electrometer. The author has examined numerous substances in this way, and finds that those which are sensitive to light have a special tendency to lose an electrostatic charge. The discharged electricity must be conveyed by ions either of the substance itself or of the superficially absorbed oxygen. Only negative charges are lost by dissipation, hence the discharged ions must be negative whether the substance is metal, sulphur, or glass. The author accordingly regards the dissipation as depending on an oxidation process, the loss of charge being effected by negative oxygen ions. In accordance with this view, oxidisable substances, such as sulphides and photographic developers, are found to lose their charges under the influence of light, whilst highly oxidised substances like sulphates and permanganates are not affected. The fact that certain substances such as zinc take a positive charge when illuminated may be similarly explained. The oxidation of phosphorus is an analogous phenomenon. J. C. P.

Dielectric Constants and Aggregation Changes of Alcohols at Low Temperatures. By Richard Abegg and W. Seitz (*Zeit. physikal. Chem.*, 1899, **29**, 242—248).—Abegg has shown that the temperature coefficient of the dielectric constant is given by the expression $-dD/dT = D/190$, that is $D = ce^{-T/190}$ (Abstr., 1897, ii, 240). To more completely test this expression, determinations of the constant were made for amylic, isobutylic, propylic, ethylic, and methylic alcohols at temperatures reaching $-140°$, the constant low temperatures being obtained by employing baths of boiling ammonia, solid carbonic anhydride and ether, or melting chloroform, toluene, ether, or ethylic bromide. The results are in very fair accord with the values calculated from the formula. In each case, when the alcohol freezes a sudden drop occurs in the constant, and there appears to be no difference between the value for the glassy mass and the crystals, so that no evidence of a continuous change was obtained. The above formula differs from that calculated from either of the refraction formulæ, but it has been shown that the coefficients so calculated are not in accord with the experimental numbers (Ratz, Abstr., 1896, ii, 288; Philip, Abstr., 1898, ii, 9). It is noteworthy that, notwithstanding the complexity of liquid alcohol molecules, the dielectric constant obtained is identical with that for nitrobenzene, so that any connection between complexity and dielectric constant appears doubtful. L. M. J.

Dielectric Behaviour of a Crystalline Liquid. By Richard Abegg and W. Seitz (*Zeit. physikal. Chem.*, 1899, **29**, 491—493).—When a compound passes from the liquid to the solid state, there is a sudden fall in the specific inductive capacity. An example of change from a homogeneous to a crystalline liquid is furnished by 1 : 4-azoxyanisoil, and it is shown that the change is not accompanied by any alteration in the value of the specific inductive capacity, apart from the gradual increase of the latter with falling temperature. When the azoxyanisoil solidifies, there is a sudden fall in the value of the specific inductive capacity from 4·3 to 2·3. These experiments show that when a liquid ceases to be homogeneous and becomes crystalline, there can be no separation of solid substance; this is in accordance with Schenck's views. J. C. P.

Conductivity of Fused Zinc Chloride. By Hermann S. Schultze (*Zeit. anorg. Chem.*, 1899, **20**, 333—339).—The varying results obtained by different investigators of this subject may be due to the difficulty of freeing zinc chloride from the last traces of water. The author has accordingly determined the conductivity of carefully dehydrated zinc chloride through a considerable range of temperature. The specific conductivity is 0·460 (ohm and cub. cm.) at 700°, and falls with the temperature, the rate of fall increasing at lower temperatures. J. C. P.

Differences of Potential between Metals and Non-aqueous Solutions of their Salts. By LOUIS KAHLENBERG (*J. Physical Chem.*, 1899, 3, 379—403).—Although the osmotic theory of the voltaic cell has led to many measurements of potential differences in aqueous solutions, but few experiments have been made with other solvents, and these have indicated that the solution tension of a metal is dependent on the solvent in which it is immersed (compare Jones, Abstr., 1894, ii, 374). The author has therefore determined the E.M.F.'s of a large number of electrodes consisting of the metal immersed in a $N/10$ solution of one of its salts in solvents other than water, those employed being methylic, ethylic, and benzylic alcohols, glycol, glycerol, pyridine, piperidine, acetone, aniline and its alkyl derivatives, quinoline, various amines, and nitrobenzene. In the case of silver electrodes, 46 E.M.F. determinations were made, and it was found that the potential differences between the metal and solution differ greatly with the solvent employed, varying from 1·2 volts in the case of acetone to 0·36 volt in propylamine; the value in aqueous solution is 0·56 volt. In all cases, the silver is positive to the solution. In groups of solvents of similar chemical nature—as, for example, the alcohols, the aliphatic amines, the amidobenzenes, &c.—the differences of potential are approximately equal, this being more marked the closer the relationship of the solvents. In the case of magnesium electrodes, the difference of potential between the metal and the $N/10$ solution in pyridine or aniline is about 0·4 volt, whilst in aqueous solution the difference is 1·06 volts, the metal being negative. The metal is hence more positive, or less negative, to the pyridine solution than to the aqueous solution, whereas the converse holds for silver. Zinc also is less negative to pyridine, aniline, quinoline, or alcohol solutions than to aqueous; in the quinoline solution, the zinc is actually positive to the solution. Cadmium and thallium show very little difference between the aqueous and pyridine solutions, lead is more positive, and copper less positive to solutions in pyridine than to those in water. The difference of potential between iron and the $N/10$ solution of ferric chloride in water is 0·031 volt, but for solutions in alcohol, nitrobenzene, and orthonitrotoluene the differences amount to more than 1 volt. If platinum is used in place of iron as the electrode, so that the chain becomes one of reduction, the differences are in the opposite sense, the metal being most positive to the aqueous solution.

These results are discussed in the light of the osmotic theory of electromotive force. For the same metal in different solutions, the E.M.F. is proportional to log. P/p, where P is the solution tension, and p the ionic pressure, which is again proportional to the dissociation, and it is evident from the above results that P must vary greatly with different solvents, and that the nature of the variation differs for different metals. Even if this supposition is made, however, other difficulties arise, as many salts yield solutions in pyridine which possess considerable conductivity, and in which Faraday's electrolytic laws are valid, although cryoscopic measurements indicate that no dissociation occurs (compare Werner, Abstr., 1898, ii, 214). The author therefore considers that the whole osmotic theory of electromotive force and conductivity is, at any rate, quite insufficient when applied to solvents other than water. L. M. J.

The Ions of Dilute Sulphuric Acid. By Wilhelm Starck (*Zeit. physikal. Chem.*, 1899, **29**, 385—400).—At high concentrations, the H_2SO_4 molecule dissociates chiefly into $\overset{+}{H}$ and $\overset{-}{HSO_4}$, at low concentrations into $\overset{+}{H}$, $\overset{+}{H}$, and $\overset{--}{SO_4}$; hence the migration number of the sulphuric acid anion decreases with increasing dilution. The proportion of H_2SO_4 molecules which dissociate into $\overset{+}{H}$ and $\overset{-}{HSO_4}$ would probably, on kinetic grounds, fall with rising temperature. The formation of persulphuric acid runs parallel with the presence of HSO_4 ions up to a certain concentration (40 per cent. acid). The poorer yield of persulphuric acid from this point onwards is probably due to its instability in concentrated sulphuric acid solution, rather than to a decrease in the quantity of HSO_4 ions. The formation of persulphuric acid is favoured by fall of temperature, and this would agree with the probable increase of HSO_4 ions as the temperature falls.

The author has determined the migration number of the sulphuric acid anion at various concentrations and at various temperatures, and finds, in general agreement with Hittorf and Wiedemann, an increase of the migration number with increasing concentration. The influence of temperature is contrary to expectation, and the temperature coefficient is approximately the same for higher concentrations as that found by Bein (Abstr., 1898, ii, 553) for low concentrations, namely, about 1/100. The increase of the migration number with the temperature is not to be attributed to a larger formation of the more complex ion, but probably to a decrease of the frictional resistance experienced by the ions. J. C. P.

Ionic Velocities. By Orme Masson (*Zeit. physikal. Chem.*, 1899, **29**, 501—526; *Phil. Trans.*, 1899, **192**, A, 331—350).—The doubtful validity of Lodge's method, and the narrow scope of Whetham's, have led the author to devise a new method of measuring directly the velocity of ions. Two flasks, each provided with a lateral opening, are connected by a graduated horizontal tube containing a mixed solution of gelatin and the salt to be investigated (compare Masson and Steele, Trans., 1899, **75**, 726). The flasks contain suitable solutions in which the electrodes dip. These anode and cathode solutions must both be distinctly coloured, the coloured ion being the cathion in the anode solution, and the anion in the cathode solution. Further, the coloured ions must migrate at a specifically slower rate than the corresponding ions of the salt in the tube. A suitable anode solution is copper sulphate with a copper anode; a suitable cathode solution is sodium chromate with a platinum cathode.

When a current passes, the progress of the cathions (for example, K) in the colourless gelatin solution is accompanied by an equal advance of the blue Cu ions: the anions (for example, Cl) are similarly followed by the yellow CrO_4 ions. The contents of the tube thus become blue at one end, colourless in the middle, and yellow at the other end. The relative length of the blue and yellow parts gives the ratio of the velocities of cathion (K) and anion (Cl); from this ratio, the migration numbers can be calculated and compared with the values found by Hittorf.

The method depends essentially on the supposition that the progress of the coloured ions is determined by the velocity of the colourless ions in front. Analysis showed that the bounding plane between coloured and colourless zones was very sharp. The relative length of the blue and yellow parts remains constant throughout one experiment and is the same for different experiments at the same concentration. The ratio of the ionic velocities for the same salt is the same when potassium ferrocyanide or potassium tartrate is substituted for sodium chromate. Theory, too, excludes any mixture of the ions, provided that the coloured ions are specifically slower than the colourless ions which precede them.

The migration numbers for the anion obtained from the ratio of the ionic velocities are, in the case of sodium, potassium, and ammonium salts, smaller than those found by Hittorf, whose values, however, hold for more dilute solutions than those used by the author. Contrary to Hittorf's observation, the migration number for the Cl ion seems to decrease slightly with increasing concentration. The relative velocities of the ions are compared with Kohlrausch's numbers, and a good agreement is found: the absolute velocities are smaller than in aqueous solution. J. C. P.

Theory of the Formation of Nickel Sulphide. By J. Livingston R. Morgan and A. H. Gotthelf (*J. Amer. Chem. Soc.*, 1899, **21**, 494—502).—Nickel sulphide, as precipitated from alkaline solutions by hydrogen sulphide, is insoluble in dilute acids, but, nevertheless, it is not precipitated by hydrogen sulphide from solutions containing insufficient acid to dissolve the sulphide already formed. This anomalous behaviour is attributed to the fact that a saturated solution of nickel sulphide has a slightly lower concentration of negative sulphide ions ($\overset{--}{S}$ or $\overset{--}{HS}$) than a saturated solution of hydrogen sulphide, so that on adding a little acid to the latter, this concentration becomes increased to nearly that of the nickel sulphide solution. Hence the compound already present (nickel sulphide or hydrogen sulphide) remains practically unchanged, the velocity of change being proportional to the difference in concentration of the two with respect to the negative ions. These views are supported by the fact that nickel sulphide is formed in the presence of a large amount of acetic acid, or of a small amount of hydrochloric acid, whilst, with neutral solutions, such as nickel dichloracetate, precipitation of the sulphide goes on until the concentrations of the negative ions of the hydrogen sulphide and the nickel sulphide become equalised. A quite analogous explanation holds for the similar behaviour of cobalt sulphide.

The solubility of zinc sulphide in dilute hydrochloric acid, in which the sulphides of nickel and cobalt are insoluble, is due to the almost complete ionisation of the chlorides of nickel and cobalt, the formation of a small quantity of chloride preventing the production of more; with zinc, however, the ionisation of the chloride is less, and the effect of this is increased by the removal of zinc ions from the solution by hydrolytic dissociation. T. H. P.

Theory of the Separation of Barium, Strontium, and Calcium from the Mixed Sulphates. By J. LIVINGSTON R. MORGAN (*J. Amer. Chem. Soc.*, 1899, **21**, 522—527).—Ammonium carbonate, or a mixture of a soluble sulphate and carbonate, transforms strontium and calcium sulphates into carbonates, leaving barium sulphate unchanged. From the solubilities of the sulphates and carbonates of barium, strontium, and calcium, the ionic concentrations are calculated, and it is found that, with strontium and calcium, the carbonates are less soluble than the sulphates, whilst with barium the converse holds. In order that any sulphate may be transformed into carbonate, sufficient CO_3 ions must be present to cause the solubility product of the carbonate to be reached in a saturated solution of the sulphate; in the case of barium, no sulphate is formed until the concentration of the CO_3 ions is at least 0·00115 gram-mol. per litre, the corresponding numbers for strontium and calcium being respectively 0·0000092 and 0·000000385. The SO_4 ions of the alkali sulphate, formed by the transformation, decrease the solubility of the insoluble sulphate, a condition of equilibrium being attained unless a sufficient excess of CO_3 ions are present. For the solubility product of barium carbonate to be reached in a 1/10 normal solution of SO_4 ions, the concentration of CO_3 ions must be at least that of a 10·5 normal solution; with strontium and calcium, this effect of the SO_4 ions is smaller, in the case of the former, a 0·0017 normal solution of the CO_3 ions being necessary in order that the solubility product of the carbonate may be reached. Hence, in a mixture of barium, strontium, and calcium sulphates, the strontium and calcium compounds are rapidly transformed into carbonates, whilst with barium sulphate, although it may also dissolve slightly, yet the soluble sulphate formed during its solution soon prevents any further reaction, and that formed from the strontium and calcium salts causes the reverse transformation to take place. T. H. P.

Electrolytic Dissociation and Toxic Effect. By J. F. CLARK (*J. Physical Chem.*, 1899, **3**, 263—316).—Fungi, when subjected to the action of deleterious agents, offer in general much more resistance than the higher plants. The hydroxyl ion $\overline{\text{OH}}$ is rather more toxic to moulds than $\overset{+}{\text{H}}$. The toxic value of the ions $\overline{\text{Cl}}$, $\overline{\text{Br}}$, $\overline{\text{I}}$ increases slightly with the atomic weight. The cyanogen radicle is a very powerful poison to fungi, potassium cyanide having nine times the toxic effect of hydrochloric acid. Mercuric chloride and silver nitrate are about equally toxic to moulds, and are followed closely by potassium dichromate, potassium chromate, and formaldehyde. Dissociation in many cases lessens the toxic action. Out of eight acids examined, six were more toxic in the molecular form than after dissociation. The toxic effect of the undissociated molecule of acetic acid is 2·8 times that of $\overset{+}{H}$, while the undissociated HCN molecule has a toxic value 76·6 times that of $\overset{+}{H}$. When hydrogen in acetic acid is replaced by chlorine, the toxicity increases, but the dissociation increases also: the two effects partially balance each other, and the relative toxic action of the chloracetic acids depends on the concentration. The anions of the mineral acids HCl, HNO_3 and H_2SO_4 have a low toxic value for fungi, less than one thirty-second of that for $\overset{+}{H}$. J. C. P.

Neutralisation, Solution, and Electrolysis. By Gustav Platner (*Chem. Centr.*, 1899, i, 466; from *Electrochem. Zeit.*, **5**, 199—205).—The combination of a hydrogen atom with an oxygen atom liberates 34·15 Cal.; the view that the union of a hydrogen atom with a hydroxyl group liberates 13·7 Cal. is regarded as incorrect.

When a metal is dissolved in acid, it first forms a hydroxide with the hydroxyl of the water or of the acid, and the hydroxide reacts with the acid. When an anhydrous salt is dissolved, water is first decomposed; the hydroxide formed from the metal of the salt and the hydroxyl of the water neutralises the acid simultaneously formed. When the process is resolved into these stages, heats of solution can be calculated, agreeing well with those observed. The author regards his conceptions as able to replace the electrolytic dissociation theory. J. C. P.

Aqueous Solutions of Double Salts. III. By Harry C. Jones and Nicholas Knight (*Amer. Chem. J.*, 1899, **22**, 110—141).—The authors have extended the experiments of Jones and Mackay (Abstr., 1897, ii, 396) and Jones and Ota (this vol., ii, 587) by studying the conductivity of solutions of the double chlorides, $2NaCl,ZnCl_2 + 3H_2O$; $SrCl_2,2CdCl_2 + 7H_2O$; $NH_4Cl,MgCl_2 + 6H_2O$; $KCl,MgCl_2 + 6H_2O$, and of the double bromides $BaBr_2,CdBr_2 + 4H_2O$; $KBr,CdBr_2 + \frac{1}{2}H_2O$; $2NaBr,3CdBr_2 + 6H_2O$, and $3NH_4Br,ZnBr_2$. The results obtained are similar in character to those of Jones and Ota (*loc. cit.*), and confirm their conclusion that the double salts exist as such to a considerable extent in the more concentrated solutions and are broken down completely by water only in very dilute solution. In the present paper, however, the evidence is made more complete by taking into account the influence exercised by one of the constituent chlorides on the dissociation of the other; it is shown that a solution of a mixture of potassium and ammonium chlorides, in molecular proportion, has a smaller conductivity than the sum of the conductivities of the two salts, although, as is well known, a double chloride is not formed. But as the differences, due to the prevention of dissociation by the presence of a common ion, between the observed and calculated conductivities of solutions of the mixtures KCl,NH_4Cl and $KCl,2NH_4Cl$ are much smaller than those observed in the case of the double chlorides studied, the conclusion reached by Jones and Ota is regarded as justified.

Attempts to obtain evidence as to the condition of the halogen double salts in aqueous solution from the molecular depression of the freezing point gave abnormal results, which will be dealt with more fully later.

The following salts are new: *sodium cadmium bromide*, $2NaBr,3CdBr_2 + 6H_2O$, forms beautiful plates; *zinc ammonium bromide*, $3NH_4Br,ZnBr_2$, crystallises from a solution containing the constituent salts in the proportion required to form the salt $2NH_4Br,ZnBr_2$.

W. A. D.

Electrolytic Behaviour of Platinic and Stannic Chlorides. By W. Dittenberger and Rudolf Dietz (*Ann. Phys. Chem.*, 1899, [ii], **68**, 853—859).—Kohlrausch (Abstr., 1898, ii, 203) and Hittorf and Salkowski (this vol., ii, 398) have shown that, in the electrolysis of platinic chloride solutions, the platinum is present in the anion, and that any deposition of the metal at the cathode is due to secondary reactions. The authors have determined the transference ratios in the case of solutions of platinic chloride and of hydrogen platinochloride; the values indicate a decrease, with concentration, of the transference ratio of the anion. The conductivity of solutions of platinic chloride increases with time, but this is not due to decomposition into hydrogen chloride and a salt poorer in platinum, as the transference ratios remain unchanged. The agreement of the values of these ratios with those obtained for hydrogen platinochloride at equal concentration show that probably the latter salt is formed in the solution as represented by the equation $2H_2PtCl_4O = H_2PtCl_6 + PtCl_2O + H_2O$ (Wagner, this vol., ii, 275). In the electrolysis of stannic chloride, some tin is deposited at the cathode, but this is due to secondary reactions, and it is improbable that decomposition into Sn and Cl ions takes place.

L. M. J.

Physico-chemical Investigation of the Uranyl Salts. By Curt Dittrich (*Zeit. physikal. Chem.*, 1899, **29**, 449—490).—The conductivity of a number of uranyl salts of inorganic and organic acids has been determined. The difference between μ_{32} and μ_{1024} for uranyl chloride, nitrate, and sulphate is abnormally high, probably because the dissociation takes place in stages. The conductivity of the uranyl salt solutions increased appreciably when they were left for some time: thus hydrolysis takes place readily; the presence of $\overset{+}{H}$ ions in the solutions was shown by the inversion of sugar, and the extent of hydrolysis was determined. Some uranyl salts (especially the oxalate) are very sensitive to light, and the corresponding decomposition was traced in the diminished conductivity. When the conductivities of uranyl salts for the same concentration are compared, it is seen that the conductivity increases with the strength of the acid, and is thus a constitutive property. The migration velocity of the uranyl ion is calculated to be 56 at 25°. Freezing point determinations showed that uranyl nitrate and chloride are dissociated in dilute solution to the extent of 90—95 per cent.; the sulphate is much less dissociated.

Solutions of various uranyl salts were mixed with solutions of the corresponding sodium salts, and both the conductivity and the freezing point depression were determined. The values obtained were in both cases less than those calculated, pointing to a decrease in the number of ions; this holds only for salts of weak acids, so that with these uranium has a decided tendency to form complex compounds. This view is supported by the observation that the specific conductivities of the mixed sodium and uranyl salts are in most cases less than those of the sodium salts themselves: in the case of the oxalate, tartrate, and citrate, the specific conductivity of the mixture decreases with increasing concentration of the uranyl salt. From the concentrations at which the specific conductivity is a minimum, conclusions are drawn as to the nature of the complex ion formed. In mixed solutions of the sodium and uranyl salts of weak acids, the formation of a complex ion may be confirmed by migration experiments. Whilst in a mixed solution of uranyl and sodium oxalates the uranium is transported to the anode, it goes to the cathode in a mixed solution of uranyl and sodium chlorides. The direction seems to depend also on the concentration. The solubility of uranyl oxalate is increased by the addition of sodium oxalate —a further proof that a complex ion is formed.

The mixture of uranyl nitrate with sodium salts of organic acids is in most cases accompanied by an absorption of heat. J. C. P.

Effect of Low Temperatures on Steel. By FLORIS OSMOND (*Compt. rend.*, 1899, **128**, 1395—1398. Compare Abstr., 1894, ii, 283, and Dewar and Fleming, 1896, ii, 4).—The temperature at which iron is transformed from the magnetic to the non-magnetic state is lowered by the addition of nickel, manganese, or carbon, either separately or collectively, and specimens of steel may be obtained, having at ordinary temperatures the same properties that iron has above 860°. The transformation, however, is always possible at lower temperatures, and the author's experiments indicate that certain nickel and manganese steels, when cooled in liquid air, become magnetic; at the same time, their specific gravity is diminished. The magnetic condition when once induced persists at high temperatures. When the proportion of the foreign element is further increased, as, for example, in a steel containing 13 per cent. of manganese, it is found that the magnetic condition is not attained even at the temperature of liquid air. The lowering of the transformation temperature of iron by the addition of other elements seems to be comparable with the lowering of the freezing point of a solvent by the increase in concentration of the dissolved substance. G. T. M.

Thermal Deformation of Crystallised Sulphates of Potassium, Rubidium and Cæsium. By ALFRED E. TUTTON (*Zeit. Kryst. Min.*, 1899, **31**, 426—457; *Phil. Trans.*, 1899, **192**, A, 455—498).—With the aid of the compensated interference dilatometer (*Phil. Trans.*, 1898, **191**, A, 313), determinations have been made of the thermal expansion in the three axial directions of the orthorhombic crystals of the normal sulphates of potassium, rubidium and cæsium. Like the other physical properties, they are functions of the atomic weights of the metals.

The constant *a* (coefficient of linear expansion at 0°).

Axis.	K_2SO_4.	Rb_2SO_4.	Cs_2SO_4.
a	0·000 036 16	0·000 036 37	0·000 033 85
b	0·000 032 25	0·000 032 14	0·000 031 95
c	0·000 036 34	0·000 034 63	0·000 035 90
Total (coeff. of cubical expn. at 0°).	0·000 104 75	0·000 103 14	0·000 101 70

The constant *b* (half the increment of the linear coefficient per degree of temperature).

Axis.	K_2SO_4.	Rb_2SO_4.	Cs_2SO_4.
a	0·000 000 0144	0·000 000 0203	0·000 000 0214
b	0·000 000 0141	0·000 000 0184	0·000 000 0182
c	0·000 000 0413	0·000 000 0380	0·000 000 0414
Total (half the increment of cubical expn. per degree of temp.)	0·000 000 0698	0·000 000 0767	0·000 000 0810

The coefficients of cubical expansion exhibit a progression corresponding with the progression of the atomic weights of the three respective metals. This is true of both the constants *a* and *b* in the general expression for the coefficient of cubical expansion, $\mathbf{a} = a + 2bt$, for any temperature *t*. The order of progression of the two constants is inverted; *a* diminishes with increasing atomic weight of the metal, while *b* increases. Consequently, the coefficients of cubical expansion of the three salts converge with rise of temperature, until they attain equality at about 136°; beyond this temperature, divergence occurs, and an increase of atomic weight is now accompanied by an increase of expansion.

In the potassium and cæsium salts, the maximum thermal axis is the crystallographic axis *c*, whilst in the rubidium salt it is *a*; but at 50° rubidium sulphate becomes thermally uniaxial, and above this temperature the maximum thermal axis is the axis *c*. As a consequence of this reversal, which is analogous to that shown by the optical characters, the coefficients of linear expansion for any one direction of the three salts do not exhibit any progression corresponding with that of the atomic weights. L. J. S.

Thermochemistry of some Opium Alkaloids. By Émile Leroy (*Compt. rend.*, 1899, **129**, 220—223).—The following table gives in Cals. the heats of combustion, formation, and combination with hydrogen chloride of codeine, thebaine, papaverine, and narcotine.

	Combustion.		Formation.	Combination with gaseous HCl.
	At const. vol.	At const. press.		
Codeine	2325·8	2327·7	+92·2	+29·74
Thebaine	2439·9	2441·8	+74·6	+24·31
Papaverine	2477·2	2478·8	+131·9	+26·48
Narcotine	2643·8	2644·8	+223·5	+21·72

The heats of neutralisation of the solid alkaloids by dilute hydrochloric acid are: codeine, +9·27 Cal.; thebaine, +6·93 Cal.; papaverine, +4·15 Cal.; narcotine, +2·33 Cal.

The heat of hydration of codeine is +2·23 Cal. (liquid H_2O) and +0·67 Cal. (solid H_2O); the heat of dissolution of the hydrate is

– 0·68 Cal. The heat of dissolution of hydrated codeine hydrochloride is – 7·79 Cal. at about 17°, and its heat of hydration is + 4·72 Cal. (liquid water) and + 1·60 Cal. (solid water).

The heat of dissolution of hydrated thebaine hydrochloride is – 5·21 Cal. at about 20°, and its heat of hydration + 5·23 Cal. (liquid H_2O) and + 3·67 Cal. (solid H_2O).

The change of the oily precipitate of papaverine into a crystallised precipitate develops + 1·26 Cal. The heat of dissolution of papaverine hydrochloride is – 4·93 Cal. at about 18°.

The heat of dissolution of anhydrous narcotine hydrochloride is – 1·99 Cal. at about 18°.

The heat of neutralisation of solid morphine by dilute hydrochloric acid being + 7·18 Cal., and by gaseous hydrogen chloride + 27·97 Cal. (this vol., ii, 465), the energy of the basic function of the alkaloids decreases in the following order: codeine, morphine, thebaine, papaverine, narcotine. C. H. B.

Minimum Boiling Points and Vapour Compositions. By J. H. Pettit (*J. Physical Chem.*, 1899, **3**, 349—365).—Bancroft has shown that it is probable that "consolute liquids with intersecting vapour pressure curves form solutions for which a maximum or minimum vapour pressure exists at some concentration." The author finds that the boiling point curves of mixtures of chloroform or acetone with methylic alcohol have minima at a concentration of about 90 per cent. of the alcohol, and reviews the similar cases at present known. In all, sixteen cases of minimum boiling points in liquids have been observed, and in ten of these the vapour pressure curves intersect, but in the remainder, vapour pressure data are not available. The composition of the vapour phase in equilibrium with the liquid was determined for mixtures of methylic alcohol and acetone, the method employed being the determination of the boiling point of small quantities distilled over between narrow limits of temperature. The vapour curve lies above that of the liquid throughout, except at the minimum boiling point, so that for any mixture of the two constituents this constant mixture must distil over first, and either alcohol or acetone remain in the flask; contrary to the statements of Otto (*Bull. Soc. Chim.*, 1894, [iii], **11**, 199) and Monnet (*ibid.*, 1895, [iii], **13**, 113), at no concentration can pure acetone pass over first by any method of distillation. L. M. J.

Some Boiling Point Curves. By John K. Haywood (*J. Physical Chem.*, 1899, **3**, 317—327).—The boiling points of mixtures of several organic liquids have been determined and the corresponding curves drawn; these show, in many cases, a maximum or minimum point. The closeness of the boiling points of the two constituents seems favourable to the existence of a maximum or minimum point, although a mixture of chloroform and carbon tetrachloride is an exception. In general, one constituent remaining the same, chemically similar substances have similar boiling point curves. A mixture, however, of acetone and chloroform shows a maximum point, whilst one of acetone and carbon tetrachloride shows a minimum point, the curves being quite dissimilar. J. C. P.

Relationship between the Melting Points of Organic Substances and the Number of Carbon Atoms in the Molecule. By Wassily Solonina (*Chem. Centr.*, 1899, i, 327—328; from *J. Russ. Chem. Soc.*, 1898, **30**, 819—822).—Monobasic saturated fatty acids with an even number of carbon atoms have a higher melting point than those with an uneven number in the series immediately preceding or following. The amides of these acids and of dibasic saturated fatty acids show the same regularity, also the normal saturated diamines, and the corresponding dibromides and diphenylic ethers. Compounds of other than normal structure do not show this regularity. In the case of the substituted malonic acids, the compounds with an uneven number of carbon atoms have the higher melting point; in that of the substituted succinic acids, increase in the number of carbon atoms is accompanied by a fall in the melting point. J. C. P.

Vapour Pressure of Solutions of Volatile Substances. By R. A. Lehfeldt (*Zeit. physikal. Chem.*, 1899, **29**, 498—500).—When a small quantity of a volatile liquid A is dissolved in a volatile liquid B, an equation deduced by Nernst takes the form $p/\pi_B = (1-\zeta)/(1-\eta)$, where p is the vapour pressure of the solution, π_B that of the solvent B; ζ is the molecular ratio of A to B in the liquid, η the molecular ratio of A to B in the vapour. For a dilute solution of B in A, $p/\pi_A = \zeta/\eta$, where π_A is the vapour pressure of the solvent A.

For a solution of tetrachloromethane in toluene, ζ was calculated to be 0·072, and found to be 0·073; for toluene in tetrachloromethane, ζ was calculated to be 0·680, and found to be 0·708. For solutions of tetrachloromethane in benzene, and benzene in tetrachloromethane, a good agreement was found between the observed and calculated values of ζ. Mixtures containing alcohol have maximum vapour pressures, and even for dilute solutions the deviations from the formulæ are considerable. For a solution of alcohol in benzene, ζ was calculated to be 0·070, and found to be 0·088. J. C. P.

Thermal Properties of Isopentane. By Sydney Young (*Zeit. physikal. Chem.*, 1899, **29**, 193—241).—The purity of the samples of isopentane employed was proved by the constancy of the boiling point, the density, critical temperature, and pressure, and by the agreement between the values of the vapour pressure obtained by the statical and dynamical methods. The boiling point was 27·95° at 760 mm., a value somewhat lower than that generally accepted, and the critical temperature and pressure were found to be 187·8° and 25,015 mm., values in good accord with previous observations. The vapour pressures were determined at temperatures from $-31°$ to the critical point by the method previously described (Trans., 1889, **55**, 483), and the results are in good accord with those calculated by the formula log. $p = a + b\alpha^t + c\beta^t$. The orthobaric volumes were determined by both direct and indirect methods (Thomas and Young, Trans., 1893, **63**, 1191), and complete tables are given for the volume of 1 gram of liquid, of vapour, and of liquid and unsaturated vapour. In measuring pressure, it was found that mercury vapour does not reach its maximum pressure for some time, and the pressure due to it is uncertain, but no appreciable error was introduced thereby.

The mean density of liquid and saturated vapour is given by the formula $D = 0{\cdot}3197 - 0{\cdot}000454t$. From the data found, tables of the isobars are obtained for pressures varying from 4000 to 56,000 mm. and for temperatures from 10° to 220°, and of the isochors for volumes ranging from 1·58 c.c. to 4000 c.c. From these, the values of dp/dt can be readily obtained for various volumes ($= b$ in equation $p = bT + a$); they are found to increase with rise of temperature when the volume is below the critical volume, but to decrease above, except for large volumes when the values are constant; the variations are too regular to be ascribed to experimental errors. At higher temperatures, the values of the expression $1000/bv$ reaches a constant value of 11·36 at a volume of 200 c.c., the value calculated from the molecular weight being 11·6. The values of a in the equation $p = bT + a$ are also given for various volumes. The ratios of the absolute temperature and molecular volumes of liquid and of vapour to the corresponding critical constants are found to be almost identical with those of benzene at 'corresponding' pressures, as are also the ratios of the actual to the theoretical vapour density, so that liquid isopentane, like benzene, consists of simple molecules (see Rose-Innes, Abstr., 1897, ii, 542). L. M. J.

Cryohydrates. By A. PONSOT (*Compt. rend.*, 1899, **129**, 98—100).—The temperature and composition of a cryohydric bath depend on the degree of purity of the salt. With a pure salt, the temperature is remarkably constant; if, however, an impure salt is employed, the temperature is not constant during solidification, the amount of variation depending on the degree of impurity, on the fraction of the solution which has solidified, and on the rate of cooling. If the vessel containing the cryohydric mixture is in direct contact with the freezing mixture, the temperature of the liquid portion is not always independent of that of the freezing mixture or of the rate of stirring. This is due to the fact that the rate of solidification of the salt does not increase so much as that of the ice in the freezing mixture, and so the cryohydric mixture becomes more and more concentrated. H. R. LE S.

Cryoscopic Behaviour of Alcohols. By WILHELM BILTZ (*Zeit. physikal. Chem.*, 1899, **29**, 249—265).—Cryoscopic observations were made in the case of a large number of alcohols in benzene and naphthalene solutions in order to further verify the conclusions previously arrived at (this vol., i, 297). The effect of molecular weight was determined by the examination of eight primary alcohols, from normal propylic to cetylic alcohol. Curves constructed for concentration against percentage difference from normal molecular weight show that in all cases the abnormality increases with concentration but to a less degree the higher the molecular weight. For determinations of constitution, therefore, the curves of compounds of approximately equal molecular weights should be compared. Eighteen secondary and tertiary alcohols were next examined and the curves for molecular weight against depression are compared with those of the primary alcohols of equal molecular weight. The general results previously found are verified, the secondary alcohols being less abnormal than the primary, but more so than the tertiary, the differences being more marked the greater the molecular weight; unsaturated alcohols give a steeper curve than the corresponding saturated compound. Ramsay and Shields have shown that the association in alcohols decreases with increasing molecular weight (Trans., 1893, 1089), a conclusion also reached by Traube (Abstr., 1896, ii, 411) and in accord with the results just described. L. M. J.

Modification of van der Waal's Equation. By LUDWIG BOLTZMANN and H. MACHE (*Ann. Phys. Chem.*, 1899, [ii], **68**, 350—351).—As a modification of van der Waal's expression, the authors propose the equation $(pT+a/v)(v-1/3b)=rT(v+2/3b)$, and show that this gives values for the pressure of carbonic anhydride at various volumes and temperatures in accord with Amagat's observations. The agreement is by no means complete, but they state that it is closer than that obtained with van der Waal's expression, and suggest that better agreement would probably be obtained in the case of the more permanent gases, such as hydrogen, argon, &c. L. M. J.

Limits of the Solid State. III. By GUSTAV TAMMANN (*Ann. Phys. Chem.*, 1899, [ii], **68**, 553—583; 629—657).—The paper contains an account of a large number of determinations of the effect of pressure on the melting or a transition point, the method being the determination of the pressure during fusion or a transition, when the substance was maintained at a constant temperature, the manometric reading having been previously verified. Where data for comparison are available, the results appear to agree well with those of other observers. The pressures are expressed throughout in kilograms per sq. cm. The compounds examined were naphthalene, water, carbonic anhydride, ethylenic bromide, hydrogen cyanide, hydrated calcium chloride, $CaCl_2 + 6H_2O$, methylthiocarbimide, paraxylene, diethylamine, dimethylethylcarbinol, trimethylcarbinol, acetic acid, sulphur, sodium, mercury, machine oil, hexachlorethane, ammonium nitrate, and silver iodide. In all cases, the curves are concave to the pressure axis as long as the latent heat of fusion or transition is positive except in a few cases of anomalous specific heats. By extrapolation of the curves, which are of the form $t=t_0+ap-bp^2$, maximum melting temperatures are indicated at the temperature and pressure corresponding with $p=a/2b$, in some cases the maximum was actually obtained. In certain cases, triple points occur where the liquid is equilibrium with two different modifications; from these points, two melting point curves branch, and also a transition curve giving the temperatures and pressures at which the modifications change in the solid state. For naphthalene, the melting point curve was determined from $t=80°$, $p=1$ to $t=190°$, $p=3600$, the maximum being indicated at 261° and $p=11,500$. The values of dT/dp at atmospheric pressure is 0·0366, that calculated from the specific volumes and latent heat of fusion being 0·0439°. For water, very interesting results were found, the pressure at $-40°$ being less than at $-39°$, so that at some temperature between $-35°$ and $-40°$ the value dT/dp becomes infinite and hence the latent heat of fusion is zero. By further cooling, if the curve is continuous, a lower temperature should be reached at which ice at atmospheric pressure would melt to an amorphous, viscid liquid. The specific volumes of ice and water do not become zero with the specific heat, the difference still being at least 2 per cent. With carbonic anhydride, a triple point occurs at $t = -7\cdot5°$, $p = 2800$, and the equations for the three curves meeting at this point were obtained. At the critical temperature of the gas, the melting point pressures of the two modifications are respectively 6070 and 4200, the transition pressure being 6500. Ethylenic bromide gave a normal curve with maximum indicated at 178° and $p = 12,900$, but above 80° a change into a second modification occurs, and the values obtained during cooling are lower than the previous set, and apparently indicate two curves cutting at about 60°. Hydrogen cyanide, examined at temperatures up to 50·9°, gave a curve represented by $t = 13\cdot4 + 0\cdot02187\,p - 0\cdot0_51475p^2$ with a maximum at 81°; calcium chloride, with $6H_2O$, gave results in accord with $t = 29\cdot7 + 0\cdot01163p - 0\cdot0_66p^2$, a maximum is indicated at 86°, and the measurements were carried to 60·2°. Dimethylethylcarbinol was examined at temperatures up to 34°, and the results are represented by $t = -9\cdot0 + 0\cdot01833p - 0\cdot0_5193p^2$; maximum $= 36\cdot5°$. With paraxylene, two curves were obtained for two modifications which at atmospheric pressure melt at 12·6° and 15° respectively. Diethylamine yields a curve consisting of two parts meeting at about −20°. Just beyond the triple point the value of dT/dp in one curve tends to become infinite, and hence the latent heat zero, whilst in the other it tends to zero, and hence the specific volumes of solid and liquid become equal. The melting point curve of trimethylcarbinol has a triple point at 60° and 1700; for acetic acid, the curve is given by $t = 16\cdot6 + 0\cdot0220p - 0\cdot0_524p^2$, and hence has a maximum at $p = 4600$, but a triple point is reached at 1900 kilos. and 44°. The melting point curve of the rhombic variety of sulphur was determined to a pressure of over 3000, and temperature of 190°; the transition curve of rhombic and monoclinic varieties was determined from 95° to the triple point at 150°, and the melting point curve of the monoclinic variety at temperatures below this was also found. The value of dT/dp at ordinary pressure was found to be 0·0294, that calculated being 0·0266. The melting point of sodium was found to increase to 120·3° at 2840 kilos. the value of dT/dp being 0·0077 (calculated 0·0068). Observations with mercury gave the value −27·2° at 2138 kilos., giving $dT/dp = 0\cdot0054$, the calculated value being 0·00507. Ammonium nitrate melts at 161°, and below this temperature forms a second modification at 125·6°, undergoing a third transition at 82·8°, whilst at 32·4° a fourth modification occurs. Below 100° therefore, three transition curves are possible and were traced; they meet in a triple point at 64·16°; the transition curve of the second to the third modification, starting at 84·6°, has a negative value for dT/dp corresponding with a negative value for the volume change during transition. Doubly refractive silver iodide changes at 145° to the regular form, and the transition curve was determined; this, like that for water, is a descending curve to about 100°, but between this temperature and 90° a discontinuity occurs, and in the portion below 90° the interesting case of an infinite value for dT/dp is reached, so that the latent heat is zero. The author then discusses the probable general form of the melting point curve.

Poynting's supposition that it is similar to the vapour pressure curve is not supported, and the assumption that the volume change and latent heat vanish together is erroneous. The author further considers that no gradual change from crystalline to liquid condition can occur, and that the form of the curve is not in accord with the idea of a crystal. The general form is probably that of a closed curve, and this is especially indicated by the curves of water, diethylamine, and silver iodide. L. M. J.

Crystalline Liquids. By RUDOLF SCHENCK and FR. SCHNEIDER (*Zeit. physikal. Chem.*, 1899, **29**, 546—557. Compare Schenck, Abstr., 1898, ii, 286, 563 ; this vol., ii, 360).—1 : 4-Azoxyanisoil melts at 116·8° to a cloudy, crystalline liquid, becoming an ordinary isotropic liquid at 134°. The process is reversible and the two modifications are enantiotropic, that is, the vapour pressure curve of the liquid cuts the vapour pressure curves of the two crystalline modifications above the point of intersection of the latter. When benzophenone is dissolved in the azoxyanisoil, the temperature at which the isotropic liquid becomes crystalline is lowered until it lies below that at which the two crystalline modifications exist together : the enantiotropic modifications therefore are now monotropic. The quadruple point at which vapour, solid crystalline substance, and the solutions of benzophenone in the isotropic and crystalline liquids exist together is 114·9°.

It has been shown that 1 : 4-azoxyanisoil and 1 : 4-azoxyphenetoil in the liquid crystalline condition form an isomorphous mixture. When, however, a solution of the latter in the former is cooled, pure solid azoxyanisoil separates out, and the depression of the solidifying point is proportional to the concentration of azoxyphenetoil. The heat of solidification is thus calculated to be 31·2 Cal. ; calorimetric determination gives 29·84 Cal., and Hulett previously found the value 29 Cal.

The temperature at which liquid crystals of 1 : 4-azoxyanisoil separate from the isotropic liquid is lowered by the addition of other substances. The author tests by a number of experiments how far this may be made the basis of a molecular weight determination. In this and similar cases, it seems that the liquid crystals do not separate out in the pure state. J. C. P.

Gaseous Reactions in Chemical Kinetics. II. Influence of Temperature on the Formation and Decomposition of Hydrogen Iodide. By MAX BODENSTEIN (*Zeit. physikal. Chem.*, 1899, **29**, 295—314).—The variation of chemical equilibrium with temperature is given by the expression $d \log. k/dT = q/RT^2$ where q is the heat development of the reaction; if q is constant therefore, its value may be deduced by the expression obtained from the integration of the above equation $q = R(\log. K_2 - \log. K_1).T_1T_2/(T_2 - T_1)$. As q, however, usually is a function of the temperature, this expression can be applied only for two temperatures not far removed, but by a number of such determinations the values of q for various mean temperatures can be obtained. In the case of the decomposition of hydrogen iodide, the author finds the expression $q = A + BT + CT^2$ and hence $\log. K = -A/RT + B \log. T/R + CT/R +$ constant, and experiments show that the found values of K agree well with those calculated for temperatures from 280° to 520°. The value of K is, however, the ratio of the velocity constants of the decomposition and formation, so that $\log. K = \log. k_1 - \log. k_2$ and hence $\log. k_1$ and $\log. k_2$ must be both expressed as temperature functions similar in form to that of $\log. K$, that is, $\log. k_1 = -a_1/T + b_1 \log. T + c_1T$ and $\log. k_2 = -a_2T$, &c., where $a_1 - a_2 = A/R$, $b_1 - b_2 = B/R$, and $c_1 - c_2 = C/R$. The values of the velocity constant for the decomposition are found and the values of the constants a_1, b_1, c_1, obtained; the calculated and found values agree well throughout the whole range of temperature. The velocity constants for the formation were next found, and the values are compared with those deduced from the formula $\log. k_2 = -(a_1 - A/R)/T + (b_1 - B/R)\log. T + (c_1 - C/R)T$, the agreement being closer than would be expected for experimental work of this nature. The value for the heat of formation of hydrogen iodide obtained by the author's formula does not agree with that found by Thomsen at 20°; not only are the calorimetric observations uncertain, however, but little reliance can be placed on values obtained by the extrapolation of 260°. The ratios of the velocity constants for a difference of 10° increase from 1·5/1 at 500° to 1·8/1 at 300°, values which, as would be expected, are somewhat less than those obtained for reactions at ordinary temperatures (this vol., ii, 548).

L. M. J.

Gaseous Reactions in Chemical Kinetics. III. Formation of Hydrogen Sulphide from its Elements. By MAX BODENSTEIN (*Zeit. physikal. Chem.*, 1899, **29**, 315—333).—The velocity of formation of hydrogen sulphide from the elements was determined at temperatures of 356°, 310°, 283°, and 234°, and the results are in good accord with those calculated for a reaction of the first order, the sulphur concentration being constant during each experiment. The values for the velocity constants were $k_{356} = 0·0028$, $k_{310} = 0·000118$, $k_{283} = 0·0000329$, and $k_{234} = 0·0000018$. The reaction is hence perfectly normal in its course, and the "limit of formation" and "false equilibrium" observed by Pélabon are not verified (Abstr., 1897, ii, 312). Since the reaction is of the first order with respect to the hydrogen, it must be represented by the equation $H_2 + S = SH_2$. With varying sulphur concentration, the velocity was found to be proportional to the square root of the concentration, a surprising result in view of the complexity of sulphur molecules. It may, however, be explained by the assumption that three actions occur—(I) $S_8 \rightleftarrows 4S_2$, (II) $S_2 \rightleftarrows 2S$, (III) $H_2 + S = SH_2$, and that of these the velocity of I is very small, and of II very great compared with III. The velocity of III will then be proportional to the square root of the concentration of the S_2 molecules, and this, owing to the rapid removal of the latter, proportional to the concentration of the S_8 molecules. The results are also verified by the comparison of the first set of experiments with constant sulphur concentration with the second set, in which it was variable; the agreement is satisfactory. The ratio of the velocity constants for a difference of 10° increases from 1·39/1 at 234° to 1·77/1 at 356°; such an increase with rise of temperature is very exceptional, but is, in this case, explicable, as, owing to the various molecular groups, an unknown proportionality factor between the active mass of the sulphur and the actual concentration exists, this factor probably increasing with rise in temperature. L. M. J.

Gaseous Reactions in Chemical Kinetics. IV. Formation and Decomposition of Hydrogen Selenide. By **Max Bodenstein** (*Zeit. physikal. Chem.*, 1899, **29**, 429—448).—Hydrogen selenide differs from hydrogen sulphide in the fact that its formation and decomposition take place under the same conditions. According to Pélabon (Abstr., 1897, ii, 251), true equilibrium is established only above 320°; below this temperature, both formation and decomposition stop short of the point of equilibrium.

Above 320°, the author finds that the union of hydrogen and selenium is much more rapid than in Pélabon's experiments, and shows that the acceleration is due to the catalytic action of a selenium deposit inside the bulbs; the velocity constant is proportional to the ratio: selenium surface/volume of bulb. The decomposition of hydrogen selenide proceeds slowly until selenium is deposited, whilst the reaction is rapid from the first, when free selenium is present.

The equation expressing the progress of the reaction is $dx/dt = k(a-x) - k_1x$, where a is the initial concentration of the hydrogen. Kistiakowsky's integration of this gives $k = \xi/t. \log. \xi/(\xi - x)$, where ξ is the maximum value of x at the point of equilibrium, and the initial concentration of the hydrogen is 1; a similar equation can be obtained for k_1. When half the bulb was coated with selenium, $k = 0{\cdot}000119$: when it was completely coated, $k = 0{\cdot}000251$, whilst an increase in the surface relatively to the volume of the bulb raised the value of k to 0·000527. A comparison of the values of k_1, (1) when no free selenium is present, (2) when free selenium is present from the first, shows that the non-catalytic decomposition of hydrogen selenide is at least ten times slower than that at the selenium surface.

This catalytic acceleration of the reaction has enabled the author to show that, even below 320°, true points of equilibrium can be reached, as the following table shows:

Temperature.	ξ from formation.	ξ from decomposition.
254°	0·1388	0·1391
274	0·1692	0·1701
301	0·2052	0·2046

It thus appears that the times allowed by Pélabon for his experiments were too short. Above 320° also, the author finds values of ξ which differ from those of Pélabon, and the point of equilibrium varies with the temperature quite differently in the two cases. Pélabon found that hydrogen selenide had a minimum dissociation at 570°; the author criticises the numbers on which this conclusion rests, and points out an error in Pélabon's formulæ. J. C. P.

Stability of the Halogen Derivatives of Benzene. By **Richard Löwenherz** (*Zeit. physikal. Chem.*, 1899, **29**, 401—422).—Chlorobenzene, bromobenzene, or iodobenzene was added to a solution of sodium in amylic alcohol, and the mixture kept, with the help of a thermostat, at 125°. The amount of halogen eliminated was determined from time to time by titration. The velocity of reaction for iodobenzene, calculated from the formula $k = 1/t.\log.a/(a-x)$, varied from $2{\cdot}09 \times 10^{-4}$ to $3{\cdot}82 \times 10^{-4}$; this value is about 90 times greater than the corresponding constant for bromobenzene. The presence of air very greatly increases the velocity of reaction, and may account for the large variation of the constant. When a current of air was led through the mixture at 125°, k for iodobenzene varied from 258×10^{-4} to 306×10^{-4}, and with a stronger current of air a still larger value was obtained. This difficulty led the author to determine only *relative* velocities of reaction under the same conditions. At 125°, and with a steady current of air passing, bromobenzene was decomposed about 550 times as rapidly as chlorobenzene. At 50°, under similar conditions, the value of k for iodobenzene is about 310 times that for bromobenzene. The influence of temperature is unexpectedly small; for bromobenzene, $k = 1{\cdot}37 \times 10^{-4}$ at 50°, and $12{\cdot}6 \times 10^{-4}$ at 125°. This is regarded as probably due to secondary causes.

Two similar solutions of sodium in amylic alcohol, through one of which air was passed for a considerable time, were equally effective, so that the acceleration of the reaction cannot be due to any oxidation products of the amylic alcohol. The influence of air on the reaction was exactly the same when ethylic alcohol was employed instead of amylic alcohol. J. C. P.

Internal Friction of Solutions of Ethereal Salts in Supercooled Thymol. By Carl Schall (*Zeit. physikal. Chem.*, 1899, **29**, 423—428).—In continuation of the author's work on the internal friction of glycerol solutions (Schall and van Rijn, *Zeit. physikal. Chem.*, 1897, **23**, 329), experiments have been made with thymol as a solvent; it is less hygroscopic, more easily obtained pure, and can be kept for some time in a supercooled condition.

When t is the time of flow, s the specific gravity, and θ the temperature, the equation $t.s = 23{\cdot}2\ (415 - \theta)/\theta \div 1{\cdot}0176 \times 150/\theta$ gives values of the product $t.s$, agreeing well with those experimentally determined. A slightly modified formula was employed at higher temperatures. Thus $t.s = f(\theta)$, and for a solution of an ethereal salt in thymol, $t_1.s_1 = f(\theta + \Delta)$, where Δ is the depression of the freezing point of the solution; this equation may be used to calculate Δ. For a 5·58 per cent. solution of amylic propionate in thymol, Δ was found $= 3{\cdot}167°$; the value calculated from the latent heat of fusion is 3·29°, from the experimentally determined molecular depression 3·22°. A 4·06 per cent. solution of ethylic valerate shows an equally good agreement, but much less satisfactory values of Δ are obtained for an ethylic acetate solution, as well as for amylic propionate solutions at higher temperatures. J. C. P.

Surface Tension of Aqueous Solutions. By Carl Forch (*Ann. Phys. Chem.*, 1899, [ii], **68**, 801—816).—The author has determined the surface tension of a number of solutions in order to test the validity of the conclusions arrived at by Traube (Abstr., 1891, 1408). The method employed was that based on the determination of the weight of a drop from a small aperture; this is dependent on the time interval between successive drops, and all weights were corrected by a linear formula to a time interval of 5 seconds and to 18°. Comparison with the results of Quincke and Volkmann indicates the validity of the method, and the molecular depression or elevation of the surface tension was determined for a number of compounds. With sodium sulphate, chloride, and nitrate, phosphoric acid, and cane sugar, it was found that the molecular elevation remains nearly constant to high dilutions, a slight decrease with dilution being observed. For nitric acid and the fatty acids (from formic to nonylic), depression occurs, the surface tension of the solution being less than that of water, and the value of the molecular depression increases greatly with dilution. In the case of valeric and the higher acids, the values reach a maximum, and afterwards decrease, so that a constant value is not attained, a result opposed to the conclusions of Traube. Curves are given for the lowering of surface tension plotted against the cube root of the concentration, and also for the latter against the molecular lowering multiplied by 1, 3, 3^2, &c., as the series from nonylic acid is descended. These curves show the approximate validity of Traube's statement that the entrance of a CH_2 group increases the molecular cohesion threefold in dilute solutions; the curve for valeric acid is, however, anomalous. The molecular depressions for formic and acetic acids calculated by a formula $w/m = k + L \cdot a$, where a is the degree of dissociation, do not agree with the observations, so that the connection with dissociation is not given by this simple expression. L. M. J.

Determination of Invasion and Evasion Coefficients in the Solution of Gases in Liquids.—Carbonic Anhydride in Water and Aqueous Salt Solutions. By CHRISTIAN BOHR (*Ann. Phys. Chem.*, 1899, [ii], **68**, 500—525).—The author has previously shown (Abstr., 1898, ii, 211) that the absorption coefficient of a gas between about 0° and 30° is given by the expression $a(T-n)=k$. A saturated solution of a gas may, however, be regarded as a system in equilibrium, in which the velocities with which the gas leaves and enters the solution are equal, and the author has attempted to determine these, which he calls the "evasion" and "invasion" velocities. The absorption coefficient was first determined for carbonic anhydride in water and in aqueous salt solutions. In the latter, also, the form of the absorption coefficient considered as a temperature function was similar to that previously found for water. The value for n is slightly lower for salt solutions than for pure water, and is not quite constant, but increases slightly with rise of temperature. In the determination of the evasion coefficient, the author first assumes that in any short interval of time the quantity of gas leaving the liquid is proportional to its concentration, that is, $dx = -b.x.dt$, where x is the concentration and b depends on the evasion coefficient, surface, and volume. This yields $t = \int_{x_0}^{x} dx/-bx$ and $b = (log.\, x_0 - log.\, x)/t\ log.\, e$. The validity of the fundamental assumption is proved by the concordance of the values of b so obtained at different concentrations. The temperature effect was next determined, and it was found that the form of the expression was $b = 0{\cdot}00081\ (T - 252{\cdot}7)$, the values so calculated agreeing well with the determinations. Similar expressions were obtained for the salt solutions, the values of the evasion being, however, considerably less than for pure water. The values of b are then corrected for surface, &c., in order to give the absolute evasion coefficient, that is, the number of cubic centimetres of the gas which leaves 1 sq. cm. of the surface per minute when its density in the liquid is 1 c.c. of gas (at 0° and 760 mm.) per c.c. of liquid. If the expression holds for low temperatures, it follows that, at a temperature $n°$, no gas would leave the solution.

The invasion coefficient is perfectly analogous to the evasion coefficient, and is similarly defined. It may be determined directly or it may be calculated, being the product of the absorption and the evasion coefficients, since in the saturated solution invasion and evasion are equal. The direct determinations were made by measuring the quantity of gas absorbed per minute when water is exposed to carbonic anhydride at constant pressure, a correction being made for the evasion during the time, inasmuch as the invasion and evasion are assumed to go on independently. The values so obtained agree well with those calculated, as previously stated. In water and the dilute salt solution (68 grams per litre), the values were approximately equal between 0° and 20°, and with the more concentrated solution they were constant to 40°. A connection appears to exist between the invasion (γ) and the salt concentration, in grams per 100 c.c. (C), the form of the equation given being $\gamma = c - k\sqrt[3]{C^2}$, from which, by extrapolation, it is found that, at a concentration of 32·95, the invasion coefficient would be zero, but the small number of solutions examined (two and pure water) are hardly sufficient to justify any deductions being drawn. If the invasion coefficient is constant, and the evasion coefficient of the form $b = k(T - n)$, it follows that the absorption must, as previously found, be of the form $a(T - n) = c$, and the actual values calculated from the two coefficients agree well with the previous determinations.

L. M. J.

The Affinity between Acids and Bases in Methylic Alcoholic Solution. By A. Minozzi (*Gazzetta*, 1899, **29**, i, 421—439).—The following table gives the changes in volume produced on mixing equivalent quantities of decinormal acids and bases in methylic alcoholic solution :

	KOH.	NaOH.	MeOK.	MeONa.
HCl	6·72	6·47	—	6·57
HBr	6·48	6·42	6·48	6·54
$CCl_3 \cdot COOH$	2·32	2·13	2·22	2·07
$CHCl_2 \cdot COOH$	2·47	2·31	2·34	2·49
$CH_2Cl \cdot COOH$	1·66	1·56	1·64	1·68
$CH_3 \cdot COOH$	1·44	1·40	1·42	1·48

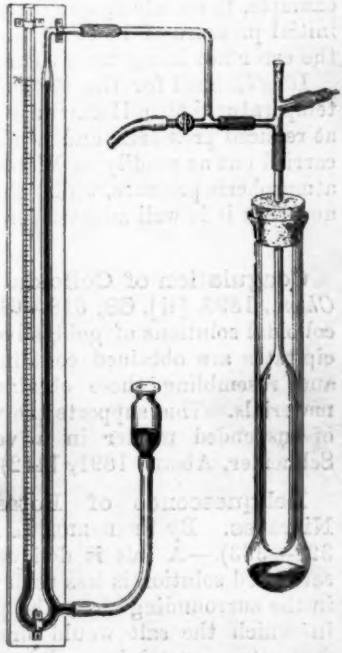
The variation in volume produced by any one acid is sensibly the same for all the bases, showing that, in methylic alcohol, the alkali hydroxides and methoxides act as equally strong bases; this confirms the results of Carrara (Abstr., 1896, ii, 511), who found that, in methylic alcohol, alkali hydroxides and methoxides have nearly the same conductivities.

From the volume alterations observed on mixing solutions of the different bases with a mixture of hydrochloric acid with one of the acetic acids, the author has calculated the following affinity constants, the numbers in the second column being those found by Ostwald for the same acids in aqueous solution :

	In methylic alcohol.	In water (Ostwald).
HCl	100·0	98·0
$CCl_3\cdot COOH$	12·3	80·0
$CHCl_2\cdot COOH$	11·1	33·0
$CH_2Cl\cdot COOH$	7·5	7·0
$CH_3\cdot COOH$	6·3	1·23

Thus, according to the volume-chemical method of measurement, in methylic alcohol hydrochloric acid is about eight times as energetic as trichloracetic acid ; by the electrolytic method, Carrara (*loc. cit.*) found the ratio of the affinities to be about 30. T. H. P.

Determination of Vapour Density under Arbitrary Pressure. By Otto Bleier and Leopold Kohn (*Monatsh.*, 1899, **20**, 505—538). —The method depends on the determination of the increase of pressure produced by the vaporisation of a known weight of substance in a special form of apparatus. The apparatus consists of (1) a strong bulb of 275 c.c. capacity heated in a Victor Meyer vapour-bath ; (2) a manometer, one limb of which is adjusted to a constant level whilst the other is graduated for reading ; (3) capillary connecting tubes including a tap leading to an air-pump. The capacity of the connecting tubes is only 2 c.c., and the total space outside the vapour jacket only 12 c.c., so that the effect of variations in the atmospheric temperature is negligible.



The molecular weight is determined from a formula of the Beckmann type, $m = q.c/p$, where q is the quantity of substance used, p the increment of pressure, and c the "constant of the apparatus." This constant depends on the dimensions of the apparatus and the temperature of the vapour jacket, but if the same bulb, or a bulb of equal volume, is always used, it will only depend on the temperature, and a variation of 3 c.c. in the volume of the bulbs will cause an error in the molecular weight of only 1 per cent. The constant may be determined in three different ways, (1) by calculation, a correction being introduced for the volume of the apparatus not heated by the vapour-jacket ; (2) by experiment, using a known weight of a pure substance of known molecular weight or by introducing known volumes of air through the air-pump tap; (3) by a combination of (1) and (2) determining the constant with a vapour jacket of, say, water, xylene, or aniline, and from this value deducing the constants for other vapour jackets by calculation. Values are given in the paper for the constant of an apparatus of standard size from the boiling point of benzene (80°) to that of sulphur (448°), but experiments have not been made at temperatures higher than the boiling point of diphenylamine (310°).

To secure good results, volatilisation of the substance must be as rapid as possible, and, as a rule, the manometer becomes nearly stationary in about a minute; the effect of diffusion is to produce a gradual fall of pressure, and the maximum reading is therefore observed, but the error due to diffusion is found to be negligible when the pressure produced by the vapour is not more than three times the initial pressure. For substances boiling at 40° above the temperature of the vapour jacket, the initial pressure may be 300 to 100 mm., and the weight of substance up to 0·1 gram; for substances boiling at 60° above the temperature of the vapour jacket, a pressure of 70 to 30 mm. may be used, and a weight of 1/4 to 1/6 millimol., the results being correct within 1 per cent.; determinations may also be made with substances boiling 70—90° above the temperature of the vapour jacket (as, for example, those which would decompose by further heating), using an initial pressure of 18 to 12 mm. and a weight of about 1/10 millimol., the error not being more than 3—4 per cent.

It is claimed for the method that it can be used at much higher temperatures than Hofmann's method for determining vapour densities at reduced pressures, and is at least equally accurate; that it can be carried out as readily as Victor Meyer's method for determinations at atmospheric pressure, whilst the calculations involved are even simpler; and that it is well adapted for studying questions of dissociation.

T. M. L.

Coagulation of Colloidal Solutions. By J. Stark (*Ann. Phys. Chem.*, 1899, [ii], **68**, 618—619).—By the addition of zinc chloride to colloidal solutions of gold, silver, or arsenious sulphide, flocculent precipitates are obtained containing a multitude of minute air-bubbles and resembling those obtained by the precipitation of suspended materials. This supports the view that colloidal solutions consist also of suspended matter in a very fine state of division (Barus and Schneider, Abstr., 1891, 1412).

L. M. J.

Deliquescence of Potassium, Sodium, and Ammonium Nitrates. By Frederick L. Kortright (*J. Physical Chem.*, 1899, **3**, 328—333).—A salt is deliquescent when the vapour pressure of its saturated solution is less than the partial pressure of the water vapour in the surrounding air. The pressure of the water vapour in the air in which the salt would first deliquesce was determined by using desiccators containing sulphuric acid solutions of known composition and vapour pressure. At 20°, ammonium nitrate deliquesces when the vapour pressure in the atmosphere is equal to or greater than 10·8 mm. of mercury; the corresponding pressures for sodium nitrate and potassium nitrate are 13 mm. and 16 mm. respectively. The latter values agree well with those calculated on the assumption that the relative lowering of the vapour pressure of a salt solution is proportional to the concentration, and independent of the temperature.

J. C. P.

Origin of Dalton's Atomic Theory. By HEINRICH DEBUS (*Zeit. physikal. Chem.*, 1899, **29**, 266—294).—A further contribution to the discussion with reference to the origin of Dalton's atomic theory (Abstr., 1898, ii, 67). The author has been unable to find any evidence that Dalton himself stated, in 1810, "that he was led to the atomic theory in Chemistry in the first instance by purely physical considerations," and regards as erroneous the statement of Roscoe and Harden that this was the case ("New View of the Origin of Dalton's Atomic Theory," p. 50). L. M. J.

Mendeléeff's Periodic System of the Elements and the New Constituents of the Atmosphere. By AUGUSTUS PICCINI (*Zeit. anorg. Chem.*, 1899, **19**, 295—305; and *Gazzetta*, 1899, **20**, 169—181).—The discovery of argon has led to much discussion as to the correctness and usefulness of Mendeléeff's system, but the author considers that the fundamental idea of this classification has been misunderstood.

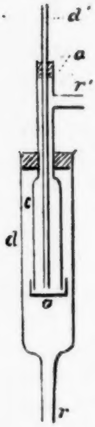
The suggestion of Rayleigh and Ramsay, that argon should be placed in the eighth group after chlorine, destroys the colligative character of this group, and disturbs the whole classification to a greater extent than Mendeléeff's view that argon may have an atomic weight of 20, and could therefore be placed in the eighth group after fluorine, thus connecting the two small periods.

The position assigned to an element in the periodic arrangement depends, not only on its atomic weight, but on its chemical properties, and the author considers it premature to try to assign places in the system to substances which form no known compound, and have therefore as yet no chemical character. The view that elements exist which have no chemical properties may be correct, and if time shows that argon and other recently discovered gases belong to this class, they cannot find a satisfactory place in Mendeléeff's scheme.

J. C. P.

The Incandescent Electric Lamp as a Source of Heat in Ether Extractions. By CYRIL G. HOPKINS (*J. Amer. Chem. Soc.*, 1899, **21**, 645—647).—The author uses five 110 volt lamps of 32-candle power for heating an air-bath on which a set of 20 Soxhlet extractors are placed. For perfect safety, it is advisable that the lamps be immersed in water, otherwise the temperature may rise above the igniting point of ether. J. J. S.

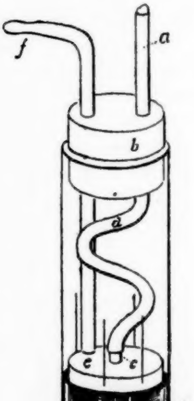
Vacuum Regulator for Distillations under Reduced Pressure. By JEAN HAUSSER (*Bull. Soc. Chim.*, 1899, [iii], **21**, 253—254).—The apparatus described is a simplification of that devised by Auger (this vol., ii, 474). The tube *d* is connected with the pump at *r*, and fitted with a bored stopper, through which a tube *c* is inserted; the latter is fitted at its lower end with a rubber membrane *o*, and is also connected with the pump by the side tube *r'*. The stopper *a* carries a tube *d'*, which is open to the air and can be made to slide up and down, so that it may be pressed against the membrane *o*. When the pump is working, a partial vacuum is produced on both sides of the membrane, and if the diminution of pressure exceeds a certain limit, depending on the elasticity of the membrane and the position of the tube *d′*, the former is pulled away from the latter and a certain quantity of air is admitted; the pressure in the apparatus is thereby increased and the membrane regains its original position; if the pressure is again diminished sufficiently the process is repeated, and thus the vibratory movement of the diaphragm prevents any considerable alteration of the pressure below a certain limit.



G. T. M.

Note.—Neither this apparatus nor Auger's is capable of preventing variations of pressure *above* the limit fixed upon at the commencement of the experiment; such variations may often arise through a falling off of the pump's efficiency. G. T. M.

Apparatus for Preventing the Backward Flow of Water during Exhaustion with a Water-pump. By Georges Chatanay (*J. Pharm.*, 1899, [vi], **9**, 524—527).—A small, cylindrical glass bottle about 12 cm. long and 3 cm. wide is interposed between the water-pump and the vessel to be exhausted. This bottle is closed with a cork, *b*, through which two glass tubes pass. The first, a straight tube, *a*, over 760 mm. long, is connected at its upper extremity to the vessel to be exhausted, and its lower end just passes through *b*, and is joined to one end of a piece of thin and narrow indiarubber tubing, *d*, the other end of which is joined to a small piece of glass tubing, *c*, which just passes through a cork, *e*, floating on mercury. It is essential that the length of the tube *c* beyond the lower face of the cork float *e* should not be more than about 1 mm. The second tube which passes through *b* has its upper end connected to the water-pump and the other just reaches to the top of the cork float. Four small rods which pass through the cork float in a vertical direction prevent it from being turned over by any sudden inrush of water. As the cork *e* floats on the mercury the end of the small tube *c* is always below the surface, and an influx of water into the apparatus leads only to a rise of mercury in the long tube *a*.



H. R. Le S.

Modification of Sprengel's Pyknometer. By A. Minozzi (*Gazzetta*, 1899, **29**, i, 406—407).—This pyknometer, intended for use with liquids which are volatile or hygroscopic, or which expand rapidly with rise of temperature, consists of a U-tube, one arm of which is a capillary tube drawn out to a point which can be closed by a glass cap, and the other a cylindrical bulb joined to a small stoppered upper chamber by means of a short capillary tube, on which a mark is scratched at the height to which the instrument is to be filled. If expansion occurs during an experiment, the liquid simply causes it to rise into the small chamber above the bulb. This modification is stated to be more convenient than that devised by Perkin (Trans., 1884, 443) for the same purpose. T. H. P.

Inorganic Chemistry.

New Explosive and Detonating Materials. By UGO ALVISI (*Gazzetta*, 1899, **29**, i, 399—405. Compare this vol., ii, 414).—To obtain the maximum effect from an ammonium perchlorate explosive fired by means of a mercury fulminate detonator, the latter must also contain ammonium perchlorate in quantity not greater than 20 per cent. Such mixed detonators are probably the most powerful used, and possess both great disruptive and great propulsive force.

T. H. P.

Use of Potassium Chlorate in Ammonium Nitrate Explosives. By HENRI LE CHATELIER (*Compt. rend.*, 1899, **128**, 1394—1395).—The addition of potassium chlorate to an ammonium nitrate explosive increases its sensibility to detonators; these two salts form isomorphous mixtures, and the addition is conveniently effected by the use of mixed crystals. Those mixed crystals which contain less than 4 parts of nitrate to 1 of chlorate have the same crystalline form as the latter salt, whilst those containing a greater proportion of nitrate crystallise in forms isomorphous with it. Mixed crystals of definite composition cannot be obtained by evaporating dilute solutions of their constituents to dryness; they are most conveniently produced by dissolving these salts in the mother liquors from previous crystallisations. G. T. M.

Action of Chromic Acid on Hydrogen. By CHARLES L. REESE (*Amer. Chem. J.*, 1899, **22**, 158—164).—Ludwig (Abstr., 1872, 590) has stated that when gypsum balls, saturated with aqueous chromic acid, are exposed in an atmosphere of hydrogen, the latter is oxidised; the author now confirms this statement, but points out that in no case is the whole of the hydrogen absorbed. Porous burnt clay balls behave in the same way as those of gypsum, but the absorption is much slower; hydrogen is also absorbed when agitated with chromic acid solution in sealed tubes containing platinised asbestos, although if platinum foil is substituted, no oxidation occurs.

Hydrogen was not oxidised by aqueous chromic acid, either alone or in presence of 1—15 per cent. by volume of concentrated sulphuric acid, at temperatures below 50°, and only very slowly below 100°. After exposure for 116 hours at 100°, 70 per cent. of the gas was oxidised. At 156°, 7 hours exposure led to the oxidation of 11 per cent. of the hydrogen, a large volume of oxygen being evolved owing to the decomposition of the chromic acid by heat; the oxidation, however, commences at temperatures below those at which oxygen is evolved by chromic acid, and thus does not seem to be dependent on the decomposition of the latter by heat.

Pure chromic acid in aqueous solution is not reduced by the hydrogen evolved on passing an electric current through the solution, but in presence of a trace of sulphuric acid or a sulphate, reduction occurs until a certain limit is reached, apparently dependent on the amount of sulphuric acid present. The behaviour of a solution of potassium dichromate under the influence of an electric current is the same as that of chromic acid.
W. A. D.

Combination of Carbon Bisulphide with Hydrogen, Nitrogen, [Argon and Carbon Monoxide]. By Marcellin P. E. Berthelot (*Compt. rend.*, 1899, **129**, 133—136).—When a mixture of gaseous carbon bisulphide (70 vols.) and hydrogen (100 vols.) is subjected to the action of the silent electric discharge at an E.M.F. of either 12·6 or 25 volts, both gases partially disappear in the ratio, by volume, $2CS_2 : 1{\cdot}01H_2$ and a yellow, resinous compound, $C_2H_2S_4$, is produced. This has an odour somewhat like that of mercaptan, is insoluble in ether, and but slightly soluble in carbon bisulphide. When a mixture of carbon bisulphide (69 vols.) and nitrogen (100 vols.) is similarly treated, the ratio between the volumes absorbed is $4CS_2 : N_2$ when the current working the coil has an E.M.F. of 12·6 volts, and $7CS_2 : N_2$ with a current of 25 volts; the discharge in the first case lasting for 6 hours, and in the second for 3 hours.

When a mixture of gaseous carbon bisulphide (70 vols.) and argon (100 vols.) is exposed to the silent electric discharge at an E.M.F. of 23·6 volts for 3 hours, the carbon bisulphide disappears together with 2 vols. of argon—the ratio being $34CS_2 : A$. After 6 hours in another experiment under similar conditions, 3 vols. of argon disappeared, the ratio being $24CS_2 : A$.

When a mixture of gaseous carbon bisulphide (68 vols.) and carbonic oxide (100 vols.) is subjected to the action of the silent electric discharge for 6 hours, the residual gas measures 3·5 vols. and consists of carbonic oxide free from carbonic anhydride. A yellow substance is formed which is a mixture of the two products obtained when the gases are separately acted on by the silent electric discharge.
H. R. Le S.

Combination of Nitrogen with Oxygen. By Marcellin P. E. Berthelot (*Compt. rend.*, 1899, **129**, 137—139).—A sample of argon containing nitrogen was purified by mixing it with an excess of oxygen and sparking the mixture over caustic potash. The ratio between the nitrogen and oxygen absorbed was 1·65 in one experiment and 1·84 in another. Now, if all the nitrogen were removed as nitric peroxide, this ratio should be 2, and the caustic potash solution should contain equal amounts of nitrite and nitrate, whereas it was found to contain an excess of the former. These facts are accounted for by supposing that the nitrogen and oxygen first combine to form nitric oxide; this oxide is then oxidised to nitrous anhydride; part of the nitrous anhydride is further oxidised to nitric peroxide, but some escapes oxidation and dissolves in the solution as such.

H. R. Le S.

[Iodine in Sea Water at Different Depths.] By Armand Gautier (*Compt. rend.*, 1899, **129**, 9—15. Compare this vol., ii, 477).—It has been shown previously that the whole of the iodine present in water taken from the surface of the Atlantic Ocean exists either in the form of soluble organic compounds or as part of the substance of infusoria, and it seemed probable that the absence of metallic iodides and iodates is due to the assimilation of these salts by living organisms inhabiting the upper layers of the ocean. To test the validity of this view, an examination was made of samples of water taken from the Mediterranean off Monaco (1) at 0·5 metre below the surface, (2) at a depth of 880 metres, (3) at a depth of 980 metres when the bottom was found. The results obtained are summarised in the following table:

	0·5 m.	880 m.	980 m.
Sp. gr. at 4°	1·03014	1·03104	1·03076
Solid residue (grams per litre)	43·40	44·78	43·41
Total halogens, calculated as sodium chloride (grams per litre)	34·92	35·99	35·68
Insoluble "organic" iodine (mgrms. per litre)	0·286	0·100	0·065
Soluble "organic" iodine (mgrms. per litre)	1·960	2·130	1·890
Iodine in inorganic combination (mgrms. per litre)	none	0·150	0·305
Total iodine	2·246	2·380	2·260

From these results, it appears that the total iodine, and also the iodine existing in the form of soluble organic compounds, are practically constant at all depths. On the other hand, the iodine existing in the form of metallic iodides and iodates decreases as the surface is approached, and ultimately disappears altogether. The variation of the iodine present in an insoluble form and forming part of the substance of organised bodies is, of course, in the converse direction, the smallest amount being detected at the greatest depth, at which but few living organisms are found. The lower values found for the sp. gr. and solid residue at a depth of 980 metres compared with those at 880 metres are attributed to the influx of fresh water from springs in the bed of the ocean.

N. L.

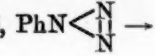
[Presence of Iodine in Algæ and Beggiatoa.] By Armand Gautier (*Compt. rend.*, 1899, **129**, 189—194).—Examination of fresh water algæ belonging to the orders *Cyanophyceæ*, *Chlorophyceæ*, *Floridæ*, and others shows that they contain from 0·25 to 2·40 milligrams of iodine per 100 grams of the dried material, a much lower proportion than that contained by salt water forms (compare Allary, Abstr., 1881, 320). *Beggiatoa* contain as much as 36 milligrams, but in lichens the quantity is much lower than in algæ. The bacillus of tetanus contains only a minute trace of iodine, if any, and that of diphtheria none. In the case of fungi, iodine varies in amount with the nature of the food supply, and may disappear altogether. C. H. B.

Recovery of Iodine from Waste Products. By F. D. CHATTAWAY and K. J. P. ORTON (*J. Soc. Chem. Ind.*, 1899, **18**, 560).—The material is heated on a water-bath with a sufficiency of nitrohydrochloric acid, the water, towards the last, being allowed to boil; the iodine is converted into monochloride, and no appreciable loss takes place. The iodine may be recovered from its monochloride in various ways, such as (1) by simple dilution with water, when the iodine will gradually separate in long crystals, or (2) the diluted liquid may be divided into two equal parts, the one is bleached by sulphurous acid or a sulphite, and, the other half now being added, all the iodine at once separates. If very pure iodine is required, the monochloride may be converted into nitrogen iodide, and the latter decomposed by Stas' method (compare Proc., 1899, **15**, 19, 21). L. DE K.

Action of Iodine on Sulphur. By LÉON PRUNIER (*J. Pharm.*, 1899, [vi], **9**, 421—424).—Iodine readily dissolves in sulphur at a temperature of 115—120°, and the resulting mass, when cold, is crystalline. The iodine is apparently uncombined, since it volatilises at the ordinary temperature, and is readily removed by a solution of sodium thiosulphate. On adding iodine (4 parts) to plastic sulphur (1 part) kept at a temperature of 200°, much heat is developed, and a product is obtained which is different from that just described, as, on treatment with sodium thiosulphate, the iodine is but very slowly removed.
H. R. LE S.

Action of Sodammonium and Potassammonium on Selenium. By C. HUGOT (*Compt. rend.*, 1899, **129**, 299—302. Compare Abstr., 1896, ii, 21; 1898, ii, 573; this vol., ii, 151).—A mixture of selenium with sodium or potassium is treated with liquid ammonia, and when the metal is in excess a white monoselenide, Na_2Se or K_2Se, is produced, which is quite insoluble in liquid ammonia. When selenium preponderates, the monoselenide dissolves in the ammonia to form a brown solution from which a brown, crystalline polyselenide separates if the solvent is evaporated off at $-25°$ and the residue cooled to $-55°$. These polyselenides, Na_2Se_4 and K_2Se_4, are decomposed by acids, yielding hydrogen selenide and selenium.

Contrary to the statement of Franklin and Krauss (this vol., ii, 208), the author finds that selenium is insoluble in anhydrous liquid ammonia. G. T. M.

Hydroxylamine. By E. WAGNER (*Chem. Centr.*, 1899, i, 244—245; from *J. Russ. Chem. Soc.*, 1898, **30**, 721—729).—Hydroxylamine is compared with hydrogen peroxide, and may be regarded as a derivative formed by replacing the OH by a NH_2 group. Hydrogen peroxide is obtained by reducing oxygen, whilst hydroxylamine or its alkylic derivatives are formed by the reduction of oxygen derivatives of nitrogen. Both compounds are unstable, the one decomposing into water and oxygen, and the other into ammonia and oxidation products. The alkylic derivatives of hydroxylamine act also as strong reducing agents, and in such reactions are, like hydrogen peroxide, themselves reduced. The close relationship of hydrazine to hydroxylamine is shown by the conversion of phenylazoimide into phenylhydroxylamine,  $PhN\Big<\begin{matrix}N\\ \|\\ N\end{matrix} \rightarrow$ $PhNH{\cdot}N{:}N{\cdot}OH \rightarrow PhNH{\cdot}OH + N_2$.

On the basis of the similarity of the NH_2 and OH groups, the following compounds are arranged in two series, the corresponding members of which are characterised by identical or similar behaviour, amidogen chloride, NH_2Cl, corresponding with hypochlorous acid, hydroxylamine with hydrogen peroxide, methylamine with methylic alcohol, hydrazine with hydroxylamine, nitramine with nitrous acid, &c. The oxidising and the reducing properties of the substituted hydroxylamines prepared by Bewad (*J. Russ. Chem. Soc.*, **20**, 125; **21**, 43) are also explained on the above theory. E. W. W.

Inorganic Hydroxylamine Compounds. By VOLKMAR KOHLSCHÜTTER and KARL A. HOFMANN (*Annalen*, 1899, **307**, 314—332. Compare Abstr., 1897, ii, 557; 1898, ii, 380).—*Hydroxylamine potassiouranate*, $UO_4(NH_3OH)(NH_3OK) + H_2O$, is prepared by dissolving uranyl nitrate (10 grams) and hydroxylamine hydrochloride (15 grams) in 100 c.c. of water, and adding a 10 per cent. solution of caustic potash until the yellow, flocculent precipitate at first formed is redissolved; reddish-yellow cubes separate slowly from the liquid, precipitation being hastened by adding alcohol. The substance disintegrates to a yellow powder when heated, and has an ammoniacal smell; it is sparingly soluble in water, and is oxidised slowly by Fehling's solution. Turmeric is coloured brown by dilute solutions. When the potassium compound is digested with water which has been saturated with carbonic anhydride, the colour changes to green and hydroxylamine uranate is produced.

Hydroxylamine sodiouranate, $UO_4(NH_3OH)(NH_3ONa) + H_2O$, forms minute, prismatic crystals. The mother liquor deposits the *salt* $UO_4(NH_3ONa)_2 + 6H_2O$, which separates in orange-red rosettes of prisms, and dissolves in its water of crystallisation when heated; it is readily soluble in water, and vigorously reduces Fehling's solution.

The *compound*, UO_5N, obtained by dehydrating hydroxylamine uranate at 125° until the weight is constant, is a brownish-black substance with metallic lustre; cold, dilute acids liberate a mixture of nitrogen and nitrous oxide, uranic acid remaining dissolved.

The *compound* $MoO_4H_2(NH_2OH)_3(NH_2OK)$, is prepared by mixing aqueous solutions of ammonium molybdate (5 grams), hydroxylamine hydrochloride (10 grams), and potassium carbonate, alcohol being then added to the yellow solution; it reduces Fehling's solution and ammoniacal silver nitrate, and decomposes when heated, forming a black powder and liberating ammonia. The substance dissolves readily in water, yielding a pale yellow, neutral solution; if carbonic anhydride is passed into this liquid, hydroxylaminomolybdic acid separates in the form of a yellowish-white, flocculent precipitate. In general behaviour, the molybdenum compound differs from the hydroxylamine uranates, and more closely resembles the vanadium derivatives already described (Abstr., 1898, ii, 381).

The *compound* $MoO_5N_3H_9$, obtained by mixing ammonium molybdate (10 grams) and hydroxylamine hydrochloride (7 grams) with 50 c.c. of 7 per cent. aqueous ammonia at 8°, dissolves with difficulty in water, and develops a bluish-green coloration when heated with dilute sulphuric acid.

Hydroxylamine orthophosphate, $PO_4H_3(NH_3O)_3$, may be obtained by adding alcohol to the filtrate from a mixture of hydroxylamine sulphate and secondary barium phosphate; it is also produced from hydroxylamine hydrochloride and ammonium metaphosphate.

Hydroxylamine arsenate, $AsO_4H_3(NH_3O)_3$, forms microscopic, rhombic prisms, yields an acid solution in hot water, and readily reduces Fehling's solution and ammoniacal silver nitrate.

M. O. F.

Action of Hydrogen Phosphide on Copper, Cuprous Oxide, and Ammoniacal Solutions of Copper Salts. By E. Rubénovitch (*Compt. rend.*, 1899, **128**, 1398—1401. Compare this vol., ii, 102).—Hydrogen phosphide reacts with precipitated copper when the temperature is raised to 180—200°: $2PH_3 + 6Cu = 2PCu_3 + 3H_2$; the reaction with cuprous oxide occurs at the ordinary temperature, and may be thus represented: $2PH_3 + 3Cu_2O = 2PCu_3 + 3H_2O$. Copper phosphide is a grey, amorphous substance melting at red heat; it is soluble in nitric acid and bromine water, has no action on potassium permanganate, but is attacked by hot concentrated sulphuric acid, hydrogen phosphide and sulphurous anhydride being evolved. When exposed to oxygen at the ordinary temperature, it is slowly oxidised; at 100°, the reaction is attended by vivid incandescence, phosphoric anhydride and metallic copper being produced.

In aqueous solutions, hydrogen phosphide (1 mol.) reacts with copper sulphate (2 mols.) to form the phosphide $P_2Cu_5 + H_2O$, and with copper acetate or formate ($2\frac{1}{2}$ mols.) to form the compound PCu_3O; it has no action on aqueous cupric chloride. In ammoniacal solutions from which air is excluded, the reaction with hydrogen phosphide is common to all copper salts, and in the case of the chloride may be represented thus: $6PH_3 + 12CuCl_2 + 6H_2O + 24NH_3 = 4PCu_3 + H_3PO_4 + H_3PO_2 + 24NH_4Cl$. In every case, 2 mols. of the salt react with 1 of the phosphide, and the copper phosphide produced is identical with that obtained from metallic copper or cuprous oxide. If oxygen be admitted after the precipitation of the copper phosphide, the latter will dissolve, and the amount of oxygen required for complete solution is equal to twice the volume of the hydrogen phosphide originally absorbed.

G. T. M.

Reducing Properties of Boron and Silicon. By André Duboin and Armand Gautier (*Compt. rend.*, 1899, **129**, 217—218).—When chlorine is passed over a red hot mixture of aluminium oxide and boron, obtained by the action of aluminium on boric anhydride, aluminium chloride and boric anhydride are the products; similar results are obtained with bromine and with iodine vapour mixed with hydrogen, whilst hydrogen sulphide yields boron sulphide. A mixture of aluminium oxide and silicon, obtained in a similar way, yields aluminium chloride, and not silicon chloride or silicochloroform, when heated to bright redness in a current of hydrogen chloride. When intimately mixed with aluminium oxide, boron or silicon therefore behave in the same way as carbon under the conditions described. C. H. B.

Preparation of Graphitoidal Silicon. By FREDERICK S. HYDE (*J. Amer. Chem. Soc.*, 1899, **21**, 663—665).—Finely powdered white sand is heated in a test-tube with magnesium powder, the brownish-black product is then powdered and fused in a Denver crucible with aluminium and cryolite. The product, consisting of an alloy of aluminium and silicon, is treated with warm hydrochloric acid, and the silicon obtained in black, glistening spangles. J. J. S.

Carbonic Anhydride on Mont Blanc. By MAURICE DE THIERRY (*Compt. rend.*, 1899, **129**, 315—316. Compare Abstr., 1897, ii, 253). —The results indicate that the amount of carbonic anhydride in the atmosphere varies only very slightly with changes of altitude; at altitudes of 1080 and 3050 metres, the amounts were respectively 26·2 and 26·9 litres per 100 cubic metres of air. G. T. M.

Argon and its Combinations. By MARCELLIN P. E. BERTHELOT (*Compt. rend.*, 1899, **129**, 71—84).—A record of experiments on the effect of the silent electric discharge on a mixture of argon with various organic compounds. The mixture was enclosed in an annular space formed by two concentric tubes, the distance between their surfaces being from 0·5 to 0·2 mm. The discharge was obtained from a Ruhmkorff coil, which was connected to a Leyden jar and fed by three or six accumulators (6·3 to 12·6 volts), the coil being so adjusted that its maximum spark was from 6 to 8 mm. long. The volume of argon varied from 5 to 10 c.c., and that of the organic compound, when a liquid, from 0·1 to 0·2 c.c.

Ethylene, glycollic ether, acetaldehyde, acetone, amylene, light petroleum, propionitrile, allylic thiocyanate, and amylamine were the members of the fatty series employed, and in no case was luminosity produced or any absorption of argon observed. Various decomposition products were formed; for example, methane, carbonic anhydride, and hydrogen were obtained in the experiment with glycollic ether, and in that with amylamine an odour of piperidine was noticed.

Benzene, toluene, cymene, terebenthene, anisoil, phenol, benzaldehyde, aniline, phenylic thiocyanate, and benzonitrile, as representative of the benzene series, gave results quite different from those obtained with members of the fatty series; a more or less intense green luminosity or glow was seen, accompanied by a decided absorption of argon. On spectroscopic examination, the characteristic lines of argon, mercury, carbon, and hydrogen were observed. The absorption of argon varied from 8 (for benzene) to 1 (for aniline) per cent. of the volume employed, and is attributed to the formation of a compound of argon, termed *phenylmercurargon*, possessing a low vapour tension, and depending for its production on the vapour tension of the organic compound which gives rise to it, and on certain complex conditions of stability and dissociation.

Absorption of argon was uncertain with furfuraldehyde and pyrroline, but amounted to 2—3 per cent. with thiophen and pyridine. The feeble, green luminosity produced in all four cases was most marked with furfuraldehyde and pyridine.

The action of argon on benzene and carbon bisulphide has also been studied more minutely (compare Abstr., 1895, i, 412; ii, 469, 498). With benzene, the luminosity and absorption appear at the same time, and the maximum absorption is about 8 per cent. of the volume of argon employed. When the temperature of the space through which the discharge takes place is too high, the phenylmercurargon compound is not obtained; also, if the volume of liquid benzene is equal to that of the argon, luminosity is not produced, even after 24 hours, possibly in consequence of the absorption of the phenylmercurargon compound by the hydrocarbon. The green luminosity immediately disappears when the electric discharge is stopped, although, if the experiment is made at twilight, a violet glow is seen for a fraction of a second, and then dies out, giving place to the permanent yellow tint of the polymerised derivative of benzene along the sides of the tube.

In the case of carbon bisulphide, it was found that, with an E.M.F. of 6·3 volts, 7 per cent. of argon was absorbed, and a fawn-coloured, solid compound was produced; with an E.M.F. of 12·6 volts, however, there was no absorption, even after 24 hours, and the product was black and carbonaceous. When a mixture of argon, hydrogen, and carbon bisulphide was subjected to the action of the silent discharge, the hydrogen disappeared in the course of 24 hours, and argon was absorbed to the extent of 10 per cent.; with a mixture of argon and equal volumes of carbon bisulphide and benzene, the amount of argon absorbed was 9 per cent.

The amounts of hydrogen, nitrogen, and argon absorbed by carbon bisulphide under the influence of the silent electric discharge were determined (see this vol., ii, 648). H. R. Le S.

Influence of Various Substances in Solution on the Crystalline Form of Sodium Chloride. By P. Orloff (*Zeit. Kryst. Min.*, 1899, **31**, 516; from *J. Russ. Chem. Soc.*, 1896, **28**, 715—774).—To determine the influence of the character of the solution on the form of crystals, numerous substances were mixed with aqueous solutions of sodium chloride, and the different forms—cube, octahedron, icositetrahedron—of the sodium chloride crystals obtained were noted. The presence of hydrochloric acid gives rise to elongated (acicular) cubes. The author considers that the influence on the form of the crystals is due to the alteration of the character of the solution by the formation of various hydrates and double salts.

Attempts to prepare $NaCl + 10H_2O$ were unsuccessful. L. J. S.

Basic Silver Copper Salts. By Paul Sabatier (*Compt. rend.*, 1899, **129**, 211—213).—The action of silver oxide on a solution of cupric nitrate yields the same compound, $3Cu(OH)_2,2AgNO_3$, as is formed by the action of cupric hydroxide on silver nitrate (Abstr., 1897, ii, 553). The rate of action of silver nitrate solution on cupric hydroxide varies with its concentration. A very concentrated solution acts rapidly on either the blue or the brown hydroxide, and forms pale blue, slender needles of a compound, $2Cu(OH)_2,2AgNO_3$.

Cupric hydroxide and silver chlorate, or silver oxide and cupric chlorate, yield the compound $2Cu(OH)_2,2AgClO_3$ in prismatic leaflets. With silver oxide and an excess of cupric chlorate, the compound $3Cu(OH)_2,Cu(ClO_3)_2$ is formed.

Cupric hydroxide and silver sulphate yield the compound $3Cu(OH)_2,Ag_2SO_4$ in short prisms, or the hydrated salt, $3Cu(OH)_2,Ag_2SO_4 + 3H_2O$, in long needles.

The double basic dithionate, $2Cu(OH)_2,Ag_2S_2O_6$, is a very bulky, flocculent, violet-blue product. C. H. B.

Agents for Removing Lime and Magnesia from Natural Waters for Industrial Purposes. By Martin L. Griffin (*J. Amer. Chem. Soc.*, 1899, **21**, 665—678. Compare this vol., ii, 476).—Comparative experiments have been made with sodium hydroxide, sodium aluminate, barium hydroxide, sodium phosphate, and sodium fluoride as reagents for removing lime and magnesia from natural waters. The results indicate that waters containing from 0·020 to 0·025 gram calcium oxide, and from 0·005 to 0·007 gram magnesium oxide cannot be appreciably purified, although frequently the amounts of these impurities can be reduced below these limits in the case of waters highly charged. The most effectual reagents for removing calcium carbonate are sodium hydroxide and sodium fluoride, and in certain cases sodium aluminate. Waters containing a large proportion of calcium sulphate and carbonate can also be successfully treated with the same reagents; barium hydroxide does not give such satisfactory results. The most useful reagent for removing magnesium salts is sodium hydroxide, then follows barium hydroxide. Sodium fluoride is of no use for removing magnesium salts, but is to be recommended when large quantities of calcium sulphate and chloride are present. Barium hydroxide is most serviceable in the treatment of acid mine waters.

J. J. S.

Arsenides of Strontium, Barium, and Lithium. By Paul Lebeau (*Compt. rend.*, 1899, **129**, 47—50).—The method of preparing calcium arsenide by reducing calcium arsenate with petroleum coke at the temperature of the electric furnace (this vol., ii, 288) has now been successfully applied to the production of the arsenides of strontium, barium, and lithium. *Strontium arsenide*, Sr_3As_2, is thus obtained as a crystalline mass which is transparent and reddish-brown in thin sections, has a sp. gr. 3·6 at 15°, and closely resembles the corresponding calcium compound in its reactions. It is attacked by fluorine at the ordinary temperature with incandescence and production of arsenious fluoride, and a similar reaction takes place with chlorine at 160°, with bromine at 200°, and with iodine vapour at higher temperatures. Vivid combustion also occurs when the arsenide is heated to dull redness in oxygen and in sulphur vapour. It is converted into strontium carbide when heated with carbon in the electric furnace. In contact with water, it is decomposed, with production of strontium hydroxide and hydrogen arsenide. Strontium arsenide reduces most metallic oxides and is violently attacked by oxidising agents. Barium arsenide, Ba_3As_2, has a sp. gr. 4·1 at 15°, and is somewhat darker in colour and more fusible than the arsenides of calcium and strontium; it also displays greater chemical activity. It burns at the ordinary temperature in fluorine, chlorine, or bromine, in oxygen at 300°, and in sulphur vapour below a dull red heat. *Lithium arsenide*, Li_3As, forms a dark brown, crystalline mass, which is transparent and reddish-brown in thin sections. It is attacked by fluorine, chlorine, bromine, or iodine at the ordinary temperature with incandescence, burns vividly when heated in oxygen at a temperature below redness, reacts violently with nitric acid, and reduces most metallic oxides at a low temperature. Attempts to prepare the arsenides of potassium and sodium were unsuccessful, these compounds being apparently unstable under the experimental conditions employed.

N. L.

Action of Magnesium on Solutions of its Salts. By Georges Lemoine (*Compt. rend.*, 1899, **129**, 291—294).—Hydrogen is evolved when magnesium is added to a solution of one of its salts. The evolution ceases when the metal becomes coated with a deposit of hydrated magnesium oxide, but recommences if, after filtering, more of the metal is added to the solution, the maximum quantity of hydrogen obtainable being about 42 per cent. of the total amount present in the water. In very dilute solutions, the action may continue for several months, but with greater concentrations it ceases after 2 or 3 days. The alteration in composition is very slight when solutions of the acetate or chloride are employed; with the sulphate, a partial precipitation occurs owing to the formation of basic salt. When excess of magnesium is added to an acid, hydrogen is rapidly evolved during the formation of the salt; this action is followed by a slower evolution of gas arising from the interaction of the salt and the metal. The phenomenon is probably due to hydrolytic dissociation of the salt into magnesium oxide and free acid; the latter acts on the metal, an oxy-salt being formed as an intermediate product; this decomposes into normal salt and oxide, the latter is precipitated, and the cycle of changes is repeated.

A similar behaviour with solutions of its salts is exhibited by aluminium, but not by zinc or cobalt. G. T .M.

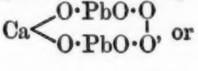
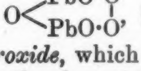
Hydrates of Magnesium Chloride. By Alexis Bogorodsky (*Chem. Centr.*, 1899, i, 245—246; from *J. Russ. Chem. Soc.*, 1898, **30**, 735—740).—Van't Hoff and Meyerhoffer have shown from theoretical considerations that magnesium chloride should form the hydrates, $MgCl_2 + 8H_2O$ and $MgCl_2 + 12H_2O$, and hydrates of these compositions have now been prepared. When a solution of magnesium chloride in water (10 mols.) is cooled to 20°, both hydrates separate out, but on removing the mass from the vessel the dodecahydrate disappears and the *octohydrate* remains as a coarse, crystalline powder, which, when mixed with the original solution cooled to —10° or – 12°, forms thick, crystalline plates. As this hydrate decomposes at – 9·8°, it is probably an isomeride of Van't Hoff and Meyerhoffer's compound which decomposes at – 3·4°. The *dodecahydrate* is obtained in large crystals by adding a crystal of the hydrate to a solution of magnesium chloride in about 12·06 mols. of water. The crystals are lighter than the mother liquor, and, according to the author, this is the first time that increase in volume has been observed in the formation of a hydrate, The hydrate may also separate from solutions which contain smaller proportions of water than the hydrate itself. It melts without decomposing at $-16°$, and on becoming liquid absorbs a large amount of heat. It may be assumed therefore that hydrates which melt without visible decomposition may exist also as liquids between certain limits of temperature. E. W. W.

Electrolysis of Fused Zinc Chloride. By HERMANN S. SCHULTZE (*Zeit. anorg. Chem.*, 1899, **20**, 323—332).—When fused zinc chloride is electrolysed with carbon electrodes, chlorine is evolved at the anode and hydrogen at the cathode, whilst the electrolyte is rendered cloudy by the separation of a bluish-grey substance. After a time, the evolution of hydrogen stops, zinc is deposited instead, and the separation of the bluish-grey substance ceases. The author has observed the same phenomena when a piece of the purest zinc is introduced into fused zinc chloride: thus the cloudiness of the latter cannot be due to the carbon electrodes.

Zinc chloride obstinately retains traces of water, and this probably reacts with zinc according to the equation $Zn + H_2O = ZnO + H_2$; analysis confirms this, and shows that when the action continues the zinc oxide contains an excess of zinc beyond that required for ZnO, whence the darkening in colour. A specimen of zinc chloride which evolved hydrogen but from which zinc oxide did not separate was found to contain hydrochloric acid. According to the method of preparation, zinc chloride may contain water or hydrochloric acid, and of these only the former interferes with a smooth electrolysis of the fused salt.

J. C. P.

Orthoplumbates of the Alkaline Earths. III. A New, Higher Oxide of Lead. By GEORG KASSNER (*Arch. Pharm.*, 1899, **237**, 409—426).—Grützner and Höhnel's calcium metaplumbate (Abstr., 1896, ii, 248) has the composition which they assigned to it; at 300°, it loses only 3/4 of its water.

When calcium metaplumbate is heated for a considerable time at 250° in a current of pure dry air, its loss of weight is less than the weight of the water given off. This is due to absorption of oxygen; the residue, a reddish-brown powder, evolves oxygen when treated with water, but more rapidly when treated with dilute nitric acid; in the latter case, lead dioxide is left undissolved, and lead and calcium nitrates go into the solution; at 330°, the compound is also decomposed. Probably this residue contains a small amount of a compound,  $\mathrm{Ca}<\begin{array}{l}\mathrm{O{\cdot}PbO{\cdot}O}\\ \mathrm{O{\cdot}PbO{\cdot}O}\end{array}$, or *calcium perplumbate*, as it may be called. For the corresponding oxide,  $\mathrm{O}<\begin{array}{l}\mathrm{PbO{\cdot}O}\\ \mathrm{PbO{\cdot}O}\end{array}$, it is proposed to reserve the name *lead peroxide* or *superoxide*, which ought not to be given to the dioxide, PbO_2, as this has not the character of a true peroxide such as hydrogen peroxide. C. F. B.

Dissociation of Diammonio-mercuric Iodide. By MAURICE FRANÇOIS (*Compt. rend.*, 1899, **129**, 296—299).—Two phases may be distinguished in the dissociation of diammoniomercuric iodide, $HgI_2,2NH_3$; the first corresponds with the formation of an intermediate *compound*, $3HgI_2,4NH_3$, and the second with the decomposition of this into mercuric iodide and ammonia. The first phase is characterised by high and the second by low dissociation pressures; in both, the pressure is constant for a given temperature, and increases as the latter is raised. At 25°, the compounds $HgI_2,2NH_3$ and $3HgI_2,4NH_3$, like the ammonio-silver chlorides (Jarry, Abstr., 1897, ii, 259), have the same dissociation pressure in aqueous solution as in a vacuum. G. T. M.

Hydrates of Manganous Chloride. By P. Kuznetzoff (*Chem. Centr.*, 1899, i, 246; from *J. Russ. Chem. Soc.*, 1898, **30**, 741—748).—When the tetrahydrate of manganous chloride, $MnCl_2 + 4H_2O$, is slowly heated, it decomposes at 58°, forming a pink powder and a liquid, and at 120° it is not completely melted (compare Brandes, *Ann. Chim. Phys.*, 1881, [v], **22**, 563). The product formed at 58° may be cooled to 23° without change, but below this temperature the tetrahydrate is regenerated. The dihydrate, $MnCl_2 + 2H_2O$, prepared by heating the tetrahydrate in filter paper at 60—63° for 1/2—1 hour, is a pale pink substance, loses water at 70°, and when exposed to the air for two months is converted into the tetrahydrate.

When the crystals, obtained by cooling a solution of the composition $MnCl_2 + 11{\cdot}7H_2O$ to $-37°$ are added to another portion of the same solution at $-21°$, the hexahydrate, $MnCl_2 + 6H_2O$, separates after 48 hours as a light pink, crystalline powder containing crystals up to 5 cm. long. From a solution, $MnCl_2 + 10{\cdot}35H_2O$, the tetrahydrate, mixed with traces of the hexahydrate, separates, and a solution, $MnCl_2 + 9{\cdot}17H_2O$, yields only the tetrahydrate. On the other hand, a solution, $MnCl_2 + 12H_2O$, even when cooled to $-48°$, only yields the hexahydrate with difficulty. At $-2°$, the hexahydrate decomposes with the tetrahydrate.

From a comparison of the hydrates of manganous, ferrous, cobaltous, and nickelous chlorides, it is seen that the greater the atomic weight of the metal the greater is the stability of the hydrate. E. W. W.

Constitution of Inorganic Compounds. XVI. Complex Cobaltammonium Compounds. By Alfred Werner, F. Steinitzer, and K. Rücker (*Zeit. anorg. Chem.*, 1899, **21**, 96—115).—*Sulphatoimido-octamminedicobalt chloride*, $[NH{:}Co_2(OH_2)(NH_3)_8SO_4]Cl_2 + 2H_2O$.—When the nitrate of the hydrosulphatoimido-octammine series is rubbed with hydrochloric acid, the salt, $[NH{:}Co_2(NH_3)_8SO_4]Cl_3 + 2H_2O$, is obtained in lustrous, violet crystals which can be recrystallised from water. This salt, when heated for 6 hours at 110°, loses 1 mol. of hydrogen chloride, and is converted into the sulphatochloride, a small quantity of imido-octamminedicobalt sulphate being formed at the same time. A similar reaction takes place when the hydrosulphatonitrate is treated with concentrated ammonia and *sulphatoimido-octamminedicobalt nitrate*, $[NH{:}Co_2(OH_2)(NH_3)_8SO_4](NO_3)_2 + 2H_2O$, is obtained.

Nitratoimidohexammine salts.—The *nitrate*,

$$[NH{:}Co_2(OH_2)_3(NH_3)_6NO_3](NO_3)_3,$$

is obtained by adding fuming nitric acid to a warm aqueous solution of tetraquoimidohexamminedicobalt nitrate. When treated with hot hydrochloric acid, it is converted into the imidohexammine chloride; with cold hydrochloric acid it yields the *chloride*,

$$[NH:Co_2(OH_2)_3(NH_3)_6NO_3]Cl_3,$$

which crystallises in lustrous, reddish-yellow leaflets.

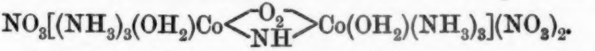
The authors have obtained two new series of compounds which contain the peroxide group, and they name them ozocobalt- and diozocobalt-salts. The *ozoimidohexamminedicobalt* salts are obtained in the conversion of crude melanochloride into nitrate after the separation of the imidotetraquohexammine salt, when the nitrate of the new series separates from the mother liquors in dark green crystals (Abstr., 1898, ii, 226). The *nitrate*,

$$[O_2NH:Co_2(OH_2)_2(NH_3)_6](NO_3)_3,$$

crystallises in dark green leaflets, and in aqueous solution yields, with hydrochloric acid, a sparingly soluble chloride, with hydrobromic acid the corresponding bromide, and with potassium cyanide a brown precipitate. Sulphurous acid converts it into a red compound which, when evaporated with hydrochloric acid, yields cobaltous salts and a small quantity of a sparingly soluble, green salt which is probably a dichlorotetrammine salt, whilst when treated with fuming nitric acid it yields a red salt which, when crystallised from hydrochloric acid, yields dichloraquotriamminecobalt chloride. The *chloride*,

$$O_2NH:Co_2(NH_3)_6Cl_3,HCl,$$

a heavy, black, crystalline powder, can be recrystallised from dilute hydrochloric acid and is acid, being in this respect similar to the imidohexammine chloride. The reactions of the nitrate of the new series with fuming nitric acid show that the six ammonia groups are symmetrically disposed with regard to the two cobalt atoms, thus, $(NH_3)_3Co{-}NH{-}Co(NH_3)_3$, and since the ozoimidohexammine salts bear the same ratio to the imidohexamminedicobalt salts as the anhydro-oxycobalt salts bear to the aquopentammine salts, the constitution of the ozoimidohexammine salts can be expressed by the formula



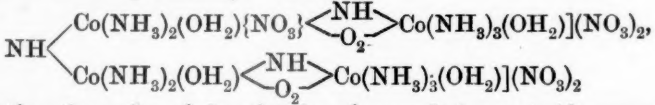
$$NO_3[(NH_3)_3(OH_2)Co{<}\begin{matrix}O_2\\NH\end{matrix}{>}Co(OH_2)(NH_3)_3](NO_3)_2.$$

Diozotri-imidodecamminetetracobalt compounds.—The *chloride*,

$$O_4(NH)_3Co_4(NH_3)_{10}Cl_8+2H_2O,$$

is obtained by dissolving oxycobaltammine nitrate (300 grams) in water (2 litres) at 50°, and, after filtration, diluting with an equal bulk of water, adding 4 litres of concentrated hydrochloric acid, and then passing a current of air through the solution for some hours. The black, crystalline precipitate of the crude chloride mixed with imidohexammine chloride, after washing with alcohol and ether, is converted into the nitrate and reconverted into the chloride. It is a black, crystalline powder sparingly soluble in cold water, more easily in warm water, is partially decomposed when heated with water at 60—70°, completely so when boiled, and gives brown, flocculent precipitates with platinic chloride and mercuric chloride. It is not decomposed by dilute acids or by concentrated hydrochloric acid. The *bromide* is a black, crystalline powder, similar to the chloride. The *nitrate*, obtained by treating the chloride dissolved in dilute nitric acid with silver nitrate, crystallises in beautiful, black, tetrahedral forms, and has the composition $O_4(NH)_3Co_4(NH_3)_{10}(OH_2)_4(NO_3)_5 + H_2O$. When treated with warm concentrated nitric acid, it yields cobaltous salts and a bright red salt which, when treated with hydrochloric acid, is converted into the dichloraquotriammine chloride. When treated with nitrous acid, it yields an imidohexammine salt, probably nitratotriaquoimidohexammine nitrate, and the mother liquors of this salt, when treated with hydrochloric acid, yield the dichlorotetrammine chloride and a dark coloured salt of unknown composition.

The diozocobalt salts have probably a constitution similar to the ozocobalt salts; a comparison of their composition shows that they are formed by the combination of 2 mols. of the ozo-salt with elimination of 1 mol. of ammonia and the addition of 1 mol. of water. In the diozo-series, 3 imido-groups are present, and, considering the decomposition products obtained from the diozo-salts by the action of sulphurous, nitric, and nitrous acids, it is most probable that their constitution is expressed by a formula,



$$\mathrm{NH}\left\langle\begin{array}{l}\mathrm{Co(NH_3)_2(OH_2)\{NO_3\}}\left\langle\begin{smallmatrix}\mathrm{NH}\\ \mathrm{O_2}\end{smallmatrix}\right\rangle\mathrm{Co(NH_3)_3(OH_2)](NO_3)_2},\\ \mathrm{Co(NH_3)_2(OH_2)}\left\langle\begin{smallmatrix}\mathrm{NH}\\ \mathrm{O_2}\end{smallmatrix}\right\rangle\mathrm{Co(NH_3)_3(OH_2)](NO_3)_2}\end{array}\right.$$

indicating the union of 2 molecules of ozo-salt by an imido-group.

E. C. R.

Constitution of Inorganic Compounds. XVII. Oxalatodiethylenediamminecobalt Salts. By Alfred Werner and A. Vilmos

(*Zeit. anorg. Chem.*, 1899, **21**, 145—158).—*Oxalatodiethylenediamminecobalt chloride*, $[Co(C_2O_4)C_2H_4(NH_2)_2]Cl + 3H_2O$, obtained by heating dichlorodiethylenediamminecobalt chloride (praseo-salt), dissolved in a small quantity of water, with oxalic acid until the green solution changes to red, is precipitated from the cold solution by alcohol. It crystallises in thin, red leaflets or ruby-red, four-sided prisms, effloresces on exposure to the air, is fairly soluble in cold, easily so in hot water, and insoluble in alcohol. It is not decomposed when heated at 130°, or when treated with concentrated sulphuric acid, and gives no precipitate with calcium chloride. With sodium dithionate, it yields a precipitate of bright red leaflets; with potassium dichromate, orange-red, six-sided leaflets; with ammonium oxalate and potassium iodide, precipitates which distinguish it at once from the corresponding tetrammine salt. The *mercurichloride*, $Co(C_2O_4)(C_2H_8N_2)HgCl_3$, crystallises in red, lustrous leaflets insoluble in water; the *aurichloride* is a bright orange yellow, insoluble powder. The *base*, $[Co(C_2O_4)C_2H_8N_2]OH$, obtained in aqueous solution by the action of freshly-prepared silver oxide on a solution of the chloride, gives a cherry red solution, is strongly alkaline, absorbs carbonic anhydride from the air, precipitates metallic hydroxides from solutions of salts of zinc, copper, &c., and is very stable. The *bromide* crystallises in dark red leaflets; the *iodide*, which is obtained mixed with a dark violet, insoluble periodide, crystallises in red, lustrous leaflets and is sparingly soluble in water. The *thiocyanate* separates from hot water in dark red, lustrous crystals; the *nitrate* crystallises from solutions above 30° without water of crystallisation in dark red aggregates, but below 30°, with $2H_2O$, in aggregates of pale red needles, and is soluble in 400 parts of water at 0°; the *hydrogen sulphate* crystallises, with $1H_2O$, in aggregates of slender, red needles and has an acid reaction; the *sulphate*, with $4H_2O$, separates in large, brownish-red crystals, is very soluble in water, and effloresces on exposure to the air; the *oxalate*, with $2H_2O$, crystallises in rose-coloured needles, is neutral, and easily soluble in water.

E. C. R.

Hydroxylamine Compound of Nickel Sulphate. By RUDOLF UHLENHUTH (*Annalen*, 1899, **307**, 332—334).—When purified hydroxylamine is added to a cold, saturated solution of nickel sulphate, the green colour gradually changes to azure blue, becoming finally transformed into deep red, resembling the colour of ferric thiocyanate; if a few drops of alcohol are then added, the compound, $NiSO_4 + 6NH_2 \cdot OH$, separates in red, quadratic crystals. The substance is decomposed by water, and reduces Fehling's solution.

M. O. F.

Action of Nitric Oxide on Chromous Salts. By GABRIEL CHESNEAU (*Compt. rend.*, 1899, **129**, 100—103).—When nitric oxide is passed into blue chromous chloride solution, protected from the air by a layer of petroleum (sp. gr. 0·87) 0·1—0·5 mm. in depth, heat is developed and the liquid becomes dark red, changing to a greenish-brown in from 1 to 2 hours at the ordinary temperature, and immediately if heated to 100°. No gas is evolved when the resulting solution is heated or placed in a vacuum. When a rapid current of the gas is passed into the solution, the amount absorbed is from 1·2 to 1·3 mols. NO for every 3 mols. $CrCl_2$, a proportion corresponding with that required for the formula $3CrCl_2,NO$; with a slow current of the gas, the absorption is less, being only 0·87 mol. NO for every 3 mols. $CrCl_2$. This difference is attributed to a secondary action between unchanged chromous salt and the newly formed compound, because the solution through which a rapid current of the gas has been passed, after exposure to the air to ensure the oxidation of any uncombined chromous chloride, precipitates cuprous oxide from Fehling's solution, but gives no ammonia by Schlœsing's method, whereas that prepared by passing a slow current of the gas gives no precipitate with Fehling's solution, but evolves ammonia on heating with an alkali. The reactions involved under the two conditions are represented respectively by the equations $2[(CrCl_2)_3NO] + 3H_2O = 3Cr_2Cl_4O + 2NH_3O$; $2[(CrCl_2)_3NO] + 2CrCl_2 + 3H_2O = 4Cr_2Cl_4O + 2NH_3$.

H. R. LE S.

Chromic Acetate. By ALBERT RECOURA (*Compt. rend.*, 1899, **129**, 158—161. Compare Abstr., 1897, ii, 172; this vol., ii, 226, 339).—Chromic acetate exists in four isomeric modifications. A solution of the normal salt is best prepared by the double decomposition of equivalent quantities of violet chromic sulphate and barium acetate. From the green solution so obtained, the author has isolated the salt $Cr(C_2H_3O_2)_3 + 5H_2O$. That this substance is a normal, and not a basic, salt is proved by the fact that it requires exactly 3 mols. of sodium hydroxide for the complete decomposition of 1 mol. of the acetate, chromic hydroxide being precipitated. Moreover, when a solution containing 1 mol. of the acetate is treated with an equivalent amount of dilute sulphuric acid, the heat evolved (12·17 Cals.) corresponds exactly with that required for the displacement of the whole of the acetic acid by sulphuric acid. The normal salt may also be obtained by dissolving freshly precipitated chromic hydroxide in the calculated amount of acetic acid.

The green solution of the normal salt gradually changes colour, and at the end of a few hours is pure violet in shade; this corresponds with the first phase of transformation. The violet colour then changes in tint during about a fortnight, the change corresponding with the second phase of transformation. The third phase requires about a year for its completion, and during this time the violet colour gradually changes to green. These colour changes correspond with the gradual conversion of the normal salt into three isomerides. In the liquid resulting from the first phase of transformation, only two of the acid radicles react with sodium hydroxide, that is, only two exist as electropositive ions, the third remaining combined with the chromium, whilst in the liquids resulting from the second and third phases only one exists in the ionic state. H. R. Le S.

Isomeric Modifications of Chromic Acetate. By Albert Recoura (*Compt. rend.*, 1899, **129**, 208—211. Compare preceding abstract).—Normal chromic acetate is best prepared by mixing freshly precipitated chromic hydroxide with the equivalent quantity of glacial acetic acid, the product being collected immediately by means of a pump, and dried on porous plates. It is a grey-lilac powder, which forms a yellowish-green solution identical with that obtained by the interaction of violet chromic sulphate and barium acetate, but changes very rapidly to one of the abnormal violet acetate.

The violet monacid acetate (*loc. cit.*) is obtained by allowing a solution of the violet acetate to evaporate over sulphuric acid in presence of acetic acid. It forms thin, brilliant, vitreous, violet lamellæ, of the composition $Cr(C_2H_3O_2)_3 + H_2O$, and when exposed to air slowly loses 1 mol. of acetic acid. When treated with sodium hydroxide, chromium is not precipitated, and the compound behaves like a monobasic acid. Thermochemical measurements show that the chromic radicle is not decomposed by sulphuric acid. The heat of neutralisation by sodium hydroxide is 13·25 Cals., which approximates to that of acetic acid, 13·40 Cals., and the difference is not due to errors of experiment, but shows that the third molecule of acetic acid is not dissociated from the rest of the compound in solution. This is confirmed by cryoscopic observations, the difference between the molecular reduction of the acetate and the product formed by neutralising it with sodium hydroxide being identical with the difference between the molecular reduction of acetic acid and sodium acetate respectively; the actual values of the molecular reductions also approximate somewhat closely. It follows that this abnormal chromic acetate is to be regarded as a complex monobasic acid, $Cr(C_2H_3O)_2,C_2H_4O_2 + 2H_2O$, containing the radicle $Cr(C_2H_3O)_2$, and the author calls it *chromomonacetic acid*.

C. H. B.

Isomeric Modifications of Chromic Acetate. By Albert Recoura (*Compt. rend.*, 1899, **129**, 288—291. Compare preceding abstracts).—When an aqueous solution of ordinary chromic acetate is left for several hours, its colour changes from green to violet, an isomeride being produced. This substance, *chromodiacetic acid*, $Cr(C_2H_3O_2),2C_2H_4O_2$, has not been isolated in the solid state, but its existence is inferred from the alterations in the properties of the solution. Alkalis no longer produce a precipitate, and 2 mols. of caustic soda are required to neutralise a solution originally containing 1 mol. of chromic acetate, the heats of neutralisation being 12·8 and 9·7 Cals. for the first and second molecules respectively. Cryoscopic observations also indicate that the solution contains the complex molecule, and not chromium acetate and free acetic acid.

The green isomeride, which is formed when a solution of chromic acetate is left for 12 months (*loc. cit.*), can be more rapidly obtained by heating to the boiling point a solution of chromic acetate (1 mol.) with acetic acid (3 mols.). The green solution, on evaporation over sulphuric and acetic acids, yields a green solid which has the composition $Cr(C_2H_3O_2)_3 + \frac{1}{2}H_2O$. This *green* chromomonacetic acid differs from its violet isomeride in containing half the amount of water; the heat of neutralisation by soda is 12·54 Cals. instead of 13·25, and different varieties of chromium hydroxide are precipitated when they are boiled with solutions of the caustic alkalis.

The paper concludes with a summary of the properties of the four isomeric forms of chromic acetate. G. T. M.

Metallic Thioantimonites. By Pouget (*Compt. rend.*, 1899, **129**, 103—104. Compare Abstr., 1897, ii, 499 and 500).—When a dilute solution of potassium thioantimonite is added to a solution of a salt of zinc, manganese, or lead, a voluminous precipitate of the trimetallic thioantimonite, $Zn_3Sb_2S_6$ (orange), $Mn_3Sb_2S_6$ (dirty rose), or $Pb_3Sb_2S_6$ (maroon) is produced. With a concentrated solution of potassium thioantimonite, the same compounds are formed, but if the potassium salt is in excess these precipitates are rapidly converted into crystalline compounds of the composition $ZnKSbS_3$ (white), $MnKSbS_3$ (rose), or $PbKSbS_3$ (maroon) respectively. These are easily decomposed by water, forming crystalline, trimetallic thioantimonites.

The compounds $Fe_3Sb_2S_6$, $Ni_3Sb_2S_6$, and $Co_3Sb_2S_6$, precipitated from solutions of salts of ferrous iron, nickel, and cobalt respectively, are very easily oxidised, and always contain potassium if prepared from concentrated solutions.

A dilute solution of potassium thioantimonite added to a solution of a copper salt gives a black precipitate of $Cu_3Sb_2S_6$, provided the copper is in excess; if, however, the potassium thioantimonite is in excess, the precipitate first formed is eventually reduced to Cu_3SbS_3. With concentrated solutions of potassium thioantimonite, the black precipitate rapidly changes to Cu_2KSbS_3, a yellow, crystalline compound, which is easily decomposed by water, forming the reddish-brown compound Cu_3SbS_3.

Potassium thioantimonite precipitates metallic mercury from a solution of a mercuric salt. H. R. Le S.

A Ruthenium Potassium Nitrite. By L. Brizard (*Compt. rend.*, 1899, **129**, 216—217).—When a dilute and slightly warm solution of the complex chloride, $Ru_2H_2(NO)Cl_3,3KCl,2HCl$, slightly acidified with hydrochloric acid, is mixed with successive small quantities of potassium nitrite until liberation of nitrogen oxides ceases, its colour changes from red to orange-yellow, and, after concentration, it deposits crystals of the complex nitrite, $Ru_2H_2(NO_2)_4,3KNO_2 + 4H_2O$. This salt is very soluble in water, but almost insoluble in a concentrated solution of potassium chloride. It becomes anhydrous at 100°, but does not begin to decompose much below 360°; at this temperature, however, decomposition is rapid. When heated with hydrochloric acid, it is rapidly reconverted into the double chloride from which it was formed.

C. H. B.

Purification of Iridium. By Émile Leidié (*Compt. rend.*, 1899, **129**, 214—215).—Iridium purified by fusion with lead is finely powdered, mixed with twice its weight of fused sodium chloride, and heated to incipient redness in a current of dry chlorine. The cooled product is treated with very dilute hydrochloric acid, and the filtered solution is heated to 50—60°, and mixed with successive small quantities of sodium nitrite until the evolution of nitrogen oxides ceases and the liquid becomes neutral to litmus. It is then carefully mixed with sufficient sodium carbonate to make it alkaline to litmus, and with a slight excess of sodium nitrite, boiled for a few minutes, cooled and filtered; iron and gold are thus eliminated. A slight excess of sodium hydroxide is then added, and the solution, after cooling, is saturated with chlorine, heated gently, and treated with a rapid current of chlorine to eliminate ruthenium and osmium in the form of peroxides. The residual liquid is repeatedly evaporated with hydrochloric acid to decompose nitrites, nitrates, and chlorates, and the residue dissolved in cold chlorine water and crystallised to remove sodium chloride. The final crystalline separations are a mixture of sodium ruthenio-chloride and sodium iridiochloride; these are carefully dried, heated in dry chlorine at 440°, cooled, and treated with cold chlorine water. Ruthenium chloride remains undissolved, whilst the iridium passes into solution, and can be precipitated in the form of ammonium iridiochloride. The successful separation of iridium and ruthenium depends on obtaining the double chlorides free from any excess of sodium chloride, and on drying very carefully both the chlorine and the mixture of double chlorides.

C. H. B.

Osmium. By Arthur Rosenheim and Edward A. Sasserath (*Zeit. anorg. Chem.*, 1899, **21**, 122—144).—*Sodium sulphonosmate*,

$$3Na_2O,OsO_3,4SO_2 + 5H_2O,$$

is obtained by passing sulphurous anhydride through a solution of perosmic acid in 20 per cent. sodium hydroxide until this is nearly neutral to litmus, and then neutralising with a solution of sodium hydrogen sulphite. It crystallises in bright brown needles, is easily soluble in water at 50°, yielding a reddish-brown solution, which soon decomposes with precipitation of a black oxide. When treated with sodium hydroxide, it yields a violet solution of sodium osmate; with barium chloride, a bright brown barium salt, and with silver nitrate, a yellowish-brown silver salt. The *potassium* salt, $7K_2O,4OsO_3,10SO_2 + 7H_2O$, obtained in a similar manner to the sodium salt, is more soluble in water than the latter, and can be recrystallised; decomposition takes place at 70°. It also crystallises with $3H_2O$ and without water. If a stronger solution of potassium hydroxide is employed, a salt of the composition $11K_2O,4OsO_3,14SO_2 + H_2O$ is obtained. Corresponding ammonium salts could not be prepared. Both the sodium and potassium salts are produced in almost theoretical quantities, and are very easily converted into other osmium salts. The sodium salt is also obtained by cautiously adding sodium hydrogen sulphite to a solution of sodium osmate, and since it yields sodium osmate when treated with sodium hydroxide and the corresponding barium and silver salts as described above, it probably has the constitution $(ONa)_2Os(SO_3Na)_4 + 5H_2O$. The potassium salt, which reacts in a similar manner, is probably derived from a salt of the composition $K_2Os_2O_7$.

Sodium osmium hexachloride, Na_6OsCl_{12}, obtained by gently heating sodium sulphonosmate in a current of hydrogen chloride, crystallises in lustrous leaflets, mixed with a small quantity of sodium hydrogen sulphite, cannot be recrystallised without decomposition, and when treated with potassium chloride is partially decomposed, forming the osmichloride, K_2OsCl_6. The corresponding potassium hexachloride is obtained by treating potassium sulphonosmate with hydrogen chloride.

Theoretical yields of the following compounds of quadrivalent osmium can be obtained from the sulphonosmates. Sodium osmichloride, $Na_2OsCl_6 + 2H_2O$, is formed by heating the sodium sulphonosmate in a current of hydrogen chloride, first at a gentle heat and finally at dull redness, and also by boiling it with excess of fuming hydrochloric acid (sp. gr. 1·19), then evaporating to dryness on the water-bath, extracting with absolute alcohol, and distilling the alcoholic solution under diminished pressure. The corresponding potassium and ammonium salts are described, those of the alkaline earths cannot be obtained by double decomposition from the sodium salt.

Sodium osmibromide, $Na_2OsBr_6 + 4H_2O$, obtained from the sulphonosmate by interaction with hydrogen bromide, crystallises in long, blackish-brown prisms having a metallic lustre. The *potassium* salt, a blackish-brown, crystalline powder having a copper-like lustre, crystallises from dilute solutions in large octahedra and is very sparingly soluble. The *ammonium* salt is a black, crystalline powder, soluble in water, and crystallises from dilute solutions in blackish-brown octahedra and tetrahedra. The *silver* salt is a flocculent, insoluble, indigo-blue precipitate.

Sodium sulphonosmate when treated with concentrated hydriodic acid, is completely decomposed with the formation of sulphurous anhydride, iodine, perosmic acid, and other products, and when gently heated in a current of dry hydrogen iodide, loses iodine and volatile osmium compounds, leaving a mixture of osmium tetriodide and iodine which can be separated mechanically. Complete decomposition also takes place with concentrated hydrofluoric acid, and a black precipitate of hydrated osmium dioxide, $OsO_2 + 4H_2O$, is obtained.

Sodium osmisulphites.—The *salt* $[Os(SO_3)_6]Na_8 + 8H_2O$ is obtained by boiling an aqueous solution of sodium osmichloride with concentrated sodium hydrogen sulphite for some time. It crystallises from dilute sodium hydrogen sulphite in microscopic, brownish-white prisms, is sparingly soluble in water, and decomposes with a bluish-green coloration, gives an intense blue precipitate when treated with alkali, and does not yield all its sulphurous acid when boiled with concentrated hydrochloric acid. It is also obtained with $3H_2O$ by leaving a mixture of sodium sulphonosmate and sodium hydrogen sulphite in a closed flask for some weeks. The *salt* $[Os(H_2O)(SO_3)_5]Na_6 + 4H_2O$, obtained by boiling sodium sulphonosmate with sodium hydrogen sulphite, is a white, crystalline powder. The *salt* $[OsCl(SO_3)_5]Na_7 + 6H_2O$, prepared by heating sodium osmichloride with a solution of sodium sulphite at 60°, is a bright violet, crystalline powder, which dissolves in boiling water with a reddish-violet coloration and then decomposes, yielding a violet precipitate. The chlorine in this compound cannot be precipitated quantitatively with silver nitrate. The *salt* $[OsO(SO_3)_4]Na_6 + 3H_2O$, obtained by the action of sodium sulphite on sodium sulphonosmate at 50°, is a deep violet, crystalline precipitate.

Potassium osmisulphites, $[Os(SO_3)_6]K_6H_2 + 2H_2O$, obtained by boiling a solution of potassium sulphonosmate with potassium hydrogen sulphite, crystallises in beautiful, white needles, is more easily soluble than the sodium salts, and can be recrystallised from water without decomposition. It is also obtained by boiling potassium osmitetrachloride with potassium hydrogen sulphite and by allowing a mixture of potassium sulphonosmate and potassium hydrogen sulphite to remain at the ordinary temperature. The *salt* $[Os(H_2O)(SO_3)_5]K_6 + 4H_2O$ is obtained, together with a small quantity of a salt containing chlorine, by adding potassium sulphite to a cold solution of potassium osmichloride; it crystallises in white needles. The chlorine compound forms long, yellow needles. The *salt* $[Os(H_2O)(SO_3)_{11}]K_{11}H_3 + 5H_2O$, obtained by the action of potassium hydrogen sulphite on potassium sulphonosmate in the cold or at a gentle heat, is a beautiful, white or pale rose compound, and can be recrystallised without decomposition.

E. C. R.

Mineralogical Chemistry.

Occurrence of Vanadium, Chromium, and Titanium in Peats. By CHARLES BASKERVILLE (*J. Amer. Chem. Soc.*, 1899, **21**, 706—707).—Small quantities of these three elements have been found in the ashes from three different samples of peat from Hyde Swamps, near the northern junction of Beaufort and Hyde Counties, North Carolina.

J. J. S.

Copper Glance pseudomorphous after Copper Pyrites from the Altai Mountains. By PAVEL V. VON JEREMÉEFF (*Zeit. Kryst. Min.*, 1899, **31**, 508; from *Bull. Acad. Sci. St. Pétersbourg*, 1897, [v], **6**, xxxvii—xxxix).—Quartz veins near the Georgieff gold washings on the rivers Berdj and Kamenka contain copper glance in lamellar masses, copper pyrites, hæmatite, chrysocolla and malachite. All these minerals have been derived from the copper pyrites, and all stages of passage from copper pyrites to copper glance can be seen. Analysis by J. A. Antipoff of the copper glance gave:

Cu.	S.	SiO_2.	Fe_2O_3.	CO_2.	Sb.	As.	CaO.	Total.
68·76	17·12	2·44	1·33	6·32	0·82	trace	1·03	97·82

L. J. S.

Cinnabar Ores in Servia. By J. Z. Raušar (*Zeit. Kryst. Min.*, 1899, **31**, 525; from *Zeit. chem. Industrie, Prag.*, 1896, 52—54).—Besides being found at the abandoned works of Avala, cinnabar occurs near Šabac as a crust on lead ores. The galena contains Pb, 55·51; Hg, 0·229; Ag, 0·01 per cent. L. J. S.

Thallium in Marcasite from Poland. By J. A. Antipoff (*Zeit. Kryst. Min.*, 1899, **31**, 515; from *J. Russ. Chem. Soc.*, 1896, **28**, 384—387).—Analysis gave:

Fe.	S.	As.	Tl.	SiO_2.	Zn.	Total.
47·831	44·772	0·783	0·311	2·840	trace	96·537

A second determination of the thallium gave 0·532. The difference (3·463 per cent.) is probably oxygen. This is the largest amount of thallium that has been noted in a pyrites-like mineral. The above analysis corrects that previously given (this vol., ii, 109).

L. J. S.

Cupro-goslarite, a New Variety of Zinc Sulphate. By Austin F. Rogers (*Kansas Univ. Quart.*, 1899, **8**, A, 105—106).—A translucent, greenish-blue incrustation on the walls of an abandoned zinc mine at Galena, Cherokee Co., Kansas, gave the following results on analysis. It has doubtless been formed by the oxidation of the blende and copper pyrites which occur in the mine. On exposure to the air, it loses some water and becomes white. Analysis gave:

ZnO.	CuO.	FeO.	H_2O.	SO_3.	Insol.	Total.
23·83	6·68	0·13	41·76	[27·02]	0·58	100·00

This amount of copper oxide corresponds with 12·48 per cent. of copper sulphate in the mineral. The percentage of water is calculated from the loss at 100°, on the assumption that six-sevenths of the water was expelled at that temperature. L. J. S.

Spinel and Forsterite from the Glenelg Limestone (Inverness-shire). By Charles Thomas Clough and William Pollard (*Quart. Journ. Geol. Soc.*, 1899, **55**, 372—380).—The limestone bands occurring in the gneisses and schists (probably of sedimentary origin) on the southern side of the Big Glen, or Glenmore, of Glenelg, contain a variety of minerals, including white diopside in large masses, a serpentinous mineral, phlogopite, graphite, tremolite, a dark hornblende, and quartz. The serpentine is sometimes seen to be derived from a colourless olivine, which is shown by analysis I to be forsterite. Lumps in the limestone consisting mainly of forsterite contain grains 2—5 mm. across of pale blue spinel (analysis II). Dark green octahedra of spinel and a violet spinel also occur.

	SiO_2.	Al_2O_3.	FeO.	CaO.	MnO.	MgO.	Loss on ignition.	Total.	Sp. gr.
I.	41·16	1·02	2·00	0·26	0·26	54·86	0·70	100·26	3·24
II.	1·20	69·80	2·03	—	—	27·30	—	100·33	3·57

The forsterite also contains traces of titanium oxide and fluorine. This association of minerals is the same as that in the metamorphic limestone of Passau in Bavaria (Abstr., 1897, ii, 413). L. J. S.

Ilmenite from Russia. By František Kovář (*Zeit. Kryst. Min.*, 1899, 31, 525; from *Rozpravy České Akad.* [*Memoirs Bohemian Acad.*], 1896, 5, Class II, No. XXXVII., 3 pp.).—The sand of a small lake in the granite district at Stepanowka, near Voronovica, Gov. Podolien, contains about a quarter per cent. of a black, granular mineral with metallic lustre and conchoidal fracture. Sp. gr. 4·543; only a few grains are attracted by the magnet. Analyses gave:

TiO_2.	FeO.	Fe_2O_3.	SiO_2.	Al_2O_3.	CaO.	MgO.	Total.
50·85	42·55	2·23	3·67	0·12	0·18	trace	99·60
51·20	43·04	2·06	2·98	0·20	0·14	trace	99·62

Deducting SiO_2, Al_2O_3, and CaO, these analyses give the formula $44FeTiO_3,Fe_2Ti_3O_9$. L. J. S.

Analyses of Bohemian Minerals. By Karl Preis (*Zeit. Kryst. Min.*, 1899, 31, 526; from *Sitz.-ber. k. böhm. Ges. d. Wiss.*, 1897, No. XIX., 5 pp.).—*Monazite* from Pisek gave:

P_2O_5.	SiO_2.	Ce_2O_3.	$(La,Di)_2O_3$.	Y_2O_3.	ThO_2.	Fe_2O_3.	CaO.	H_2O.	Insol.	Total.
27·57	1·46	31·05	26·64	4·02	5·85	1·32	0·41	0·42	1·96	100·70

There is no simple relation between the amounts of silica and thoria, so they are probably not present as thorite.

Phenakite from Ober-Neusattel gave: SiO_2, 54·27; BeO, 45·17; H_2O, 0·53 = 99·98.

Damourite, from the primitive limestone at Tabor, gave:

SiO_2.	Al_2O_3.	Fe_2O_3.	CaO.	K_2O.	Na_2O.	H_2O.	Total.
43·69	39·57	1·02	0·60	9·98	0·90	4·97	100·73

Delvauxite occurs at Trpin, near Beraun, in lenticular nodules with wrinkled surfaces, and, in the interior, of a brown colour. Analysis by E. Butta gave:

P_2O_5.	Fe_2O_3.	Al_2O_3.	CaO.	CO_2.	H_2O.	Insol.
18·45	38·74	2·71	9·63	1·38	26·22	3·95

Deducting calcium carbonate, this gives the formula

$Ca_3(PO_4)_2,3Fe_3(OH)_6PO_4,20H_2O$. L. J. S.

A New Cerium Mineral from the Caucasus. By G. Tschernik (*Zeit. Kryst. Min.*, 1899, 31, 513; from *J. Russ. Chem. Soc.*, 1896, 28, 345—359).—A pebble from Gov. Batum, South Caucasus, consists of an opaque, black mineral, with greasy lustre and white streak. It is very brittle, and has an uneven to splintery fracture. H = 5—6; sp. gr. 5·08. It encloses small crystals of copper pyrites. The mean of three closely agreeing analyses made on material from different parts of the pebble is:

SiO_2.	CeO.	LaO.	DiO.	YO.	ErO.	ZrO_2.	TiO_2.	ThO_2.
6·57	34·20	6·73	2·27	6·97	0·67	11·67	14·73	0·73
	UO.	CaO.	FeO.	CuO.	P_2O_5.	SO_3.	H_2O.	
	0·03	2·33	3·70	0·67	3·30	0·97	3·43	

A pebble of wolframite from the river Tschoroch, near the town Batum, gave:

WO_3.	MoO_3.	SnO_2.	Fe_2O_3.	MnO.	Total.	Sp. gr.
74·1	1·6	5·1	17·5	1·3	99·6	7·53

L. J. S.

Argon and Helium in Cerium Minerals from the Caucasus. By G. Tschernik (*Zeit. Kryst. Min.*, 1899, **31**, 514; from *J. Russ. Chem. Soc.*, 1897, **29**, 291—302).—Analysis of gas from the cerium mineral from the Caucasus (preceding abstract) gave: O, 4·8; H, 3·6; N + argon, 90·5 = 98·9.

Analysis of the ash of coal from Tkwibuli, near Kutais, gave approximately:

Helium.	CeO.	LaO.	DiO.	SiO_2.	Al_2O_3.	$CaSO_4$.
1·1	3·86	3·71	2·34	18·0	11·0	52·0

It also contains Fe, Mg, Mn, K, Na, Y. L. J. S.

Loranskite, a New Mineral. By Michail P. Melnikoff (*Zeit. Kryst. Min.*, 1899, **31**, 505; from separate publication, *St. Petersburg*).—Loranskite is a massive, black mineral from the quartz-veins at Imbilax, near Pitkäranta, Finland. It is brittle, and has a conchoidal fracture; strong sub-metallic lustre; H = 5; sp. gr. about 4·6. Streak, greenish-grey. On the edges it is translucent and greenish-yellow; optically isotropic. L. J. S.

Analysis of Loranskite. By Petr D. Nikolaéeff (*Zeit. Kryst. Min.*, 1899, **31**, 505; from *Verh. k. russ. min. Ges.*, 1897, [ii], **35**, Protokolle, 11—13. Compare preceding abstract).—A preliminary analysis gave:

Ta_2O_5.	Y earths.	CeO.	CaO.	Fe_2O_3.	ZrO_2.	Loss on ignition.	Total.	Sp. gr.
47·00	10·00	3·00	3·30	4·00	20·00	8·15	95·45	4·162

Also some sulphur, titanium and manganese. Rare earths showing an absorption spectrum are absent. The mineral is only slightly attacked by acids or by fusing with alkalis. It is completely decomposed by fusing with potassium fluoride. L. J. S.

Aluminium Phosphate from Moravia. By František Kovář (*Zeit. Kryst. Min.*, 1899, **31**, 525; from *Rozpravy České Akad.* [*Memoirs Bohemian Acad.*], 1896, **5**, class II, No. XV (II), 7 pp.).—On the walls of crevices in ochreous limonite from Gross-Tresny near Oels, are drusy spheres, with an internal radial structure of a light grey mineral. At first it is translucent, but on exposure to the air it becomes dull and opaque. Fresh pure material has sp. gr. 2·617; H = 4. Analyses gave:

Al_2O_3.	Fe_2O_3.	CaO.	MgO.	MnO.	P_2O_5.	H_2O.	Insol.	Total.
42·28	0·98	0·56	0·42	trace	29·01	26·86	0·25	100·36
42·17	1·04	0·49	0·30	trace	28·94	26·93	0·34	100·21

At 100°, there is a loss of 10·32, and at 200°, of 16·55 per cent. of water, the remainder being expelled only at a red heat. In composition, the mineral comes between peganite and fischerite, and agrees best with sphærite. L. J. S.

Analyses of Phosphates from New South Wales. By John C. H. Mingaye (*Rept. Australian Assoc.*, 1898, **7**, 332—333; and *Records Geol. Survey N.S. Wales*, 1899, **6**, 116—118).—Pyromorphite from Braidwood, near Little River, gave :

PbO.	Pb.	P_2O_5.	V_2O_5.	Cl.	Fe_2O_3.	CaO.	H_2O.	Insol.	Total.
69·40	6·57	15·22	trace	2·26	0·62	trace	0·86	4·67	99·60

Partial analyses are also given of apatite (Abstr., 1898, ii, 386), marsupial excrement, phosphatic deposits from Moruya Caves, and of gem gravels containing zircon and phosphates of the rare earths. L. J. S.

Phosphatic Deposits in the Jenolan Caves, N. S. Wales. By John C. H. Mingaye (*Rept. Australian Assoc.*, 1898, **7**, 327—331; and *Records Geol. Survey N.S. Wales*, 1899, **6**, 111—116).—The large and numerous Jenolan caves are in a thick bed of Siluro-Devonian limestone. The following analyses are given of materials from the caves :

I. Reddish marl, which partly fills portions of the caves ; it also contains MnO, trace, and organic matter, 0·24 per cent.

II and III. Light, porous, white substance, occurring as veins in the white and red marls ; it is soluble in dilute hydrochloric acid. Trace of chlorine in II.

IV and V. A deposit under a layer of gypsum on the floor of the cave. Contains also traces of chlorine, and, in IV, SO_3, 5·39 ; in V, SO_3, 28·67 per cent.

VI. Light, fluffy, fungoid substance on the walls ; it resembles very light wadding, and is easily blown about. Contains also $CaCO_3$, 76·03 ; $MgCO_3$, 6·12 ; $SrCO_3$, trace, and organic matter, 1·32 per cent.

VII. Same as VI. Contains also $CaCO_3$, 72·57 ; $MgCO_3$, 5·28 ; $SrCO_3$, trace, and organic matter, 1·14 per cent.

VIII. A nodular, grey substance.

	H_2O.	SiO_2.	Al_2O_3.	Fe_2O_3.	CaO.	MgO.	K_2O.	Na_2O.	P_2O_5.	CO_2.	Total.
I.	4·50	63·41	18·02	7·33	0·16	0·79	5·09	trace	0·08	—	99·62
II.	33·60	0·70	26·83	0·72	8·10	0·14	0·09	nil	30·04	0·15	100·37
III.	9·83	50·10	13·88	8·65	1·02	0·14	1·35	trace	15·38	0·12	100·47
IV.	16·82	37·82	0·64	trace	22·66	0·32	0·11	—	15·71	0·24	99·71
V.	22·59	2·78	0·10	nil	31·52	0·09	trace	—	14·50	0·10	100·35
VI.	1·88	13·22	1·46		—	—	—	—	0·28	—	100·31
VII.	1·48	17·26	1·94		—	—	—	—	trace	—	99·67
VIII.	10·31	54·13	15·13	7·46	nil	trace	1·69	0·87	10·63	—	100·22

Minervite also occurs in the caves (Abstr., 1898, ii, 386).

Nitre, as a white efflorescence from crevices, contains small quantities of lime, magnesia, chlorine and sulphuric acid.

Bat guano and bone breccias are not associated with these substances.

The phosphoric acid has doubtless been derived from bones, and in acting on the marls has given rise to potassium and aluminium phosphates (compare Abstr., 1896, ii, 185). L. J. S.

Garnet from the Urals. By V. VON WOROBIEFF (*Zeit. Kryst. Min.*, 1899, **31**, 504; from *Verh. k. russ. min. Ges.*, 1897, **35**, 19—42).—The optical characters of garnets from the Eugenie-Maximilianoff mines are described; they are in agreement with those described by Karnojitsky from the same locality (this vol., ii, 37). The yellow dodecahedral crystals show well-marked optical anomalies, and the optical orientation varies in zones of different colour. The author considers garnet to be pseudo-cubic, and the twin-lamellæ to be the result of paramorphic strains. Analyses of hessonite gave:

SiO_2.	TiO_2.	Fe_2O_3.	Al_2O_3.	CaO.	MgO.	Total.
39·3	0·4	6·3	17·9	35·5	1·3	100·7
39·5	0·2	6·2	17·6	34·5	1·8	99·8

L. J. S.

Garnet pseudomorphous after Idocrase from the Urals. By PAVEL V. VON JEREMÉEFF (*Zeit. Kryst. Min.*, 1899, **31**, 505; from *Verh. k. russ. min. Ges.*, 1897, [ii], **35**, Protokolle, 14—16).—Pebbles and fragments with parting planes, and pyramidal crystals with the forms of idocrase, are found in the gold washings on the Borsowka river, near Kyschtymsk; they consist of a microcrystalline aggregate of garnet. Analysis by P. Nikolaéeff gave:

SiO_2.	Al_2O_3.	Fe_2O_3.	CaO.	MgO.	Loss on ignition.	Total.
36·58	18·67	4·33	35·57	3·48	0·75	99·38

The idocrase has here been altered to pure garnet without being intermixed with clinochlore, diopside, &c. L. J. S.

Fibrous Forms of Silica from Moravian Serpentines. By JINDŘICH LADISLAV BARVÍŘ (*Zeit. Kryst. Min.*, 1899, **31**, 525; from *Sitz.-ber. k. böhm. Ges. d. Wiss.*, 1897, No. XIV, 8 pp.)—By their optical characters, quartzine, chalcedony, lutecite and lussatite are identified from the quartzose veins in Moravian serpentine. Lussatite from Ratkowic is white and fibrous, and occurs mixed with opal, from which it has probably been derived. Sp. gr. 2·015. Analysis gave: SiO_2, 90·64, loss on ignition, 2·62 per cent.; also MgO, FeO and Al_2O_3.

L. J. S.

Minerals from Moravia. By FRANTIŠEK KOVÁŘ (*Zeit. Kryst. Min.*, 1899, **31**, 523—525; from *Rozpravy České Akad.* [*Memoirs Bohemian Acad.*], 1896, **5**, Class II, No. XV (I), 18 pp.).—The minerals described are from the graphite mines of Gross-Tresny.

Stolpenite fills crevices in the limestone which carries the graphite. It is earthy and compact with a greasy lustre, and is brown on the surface, but siskin-green on a fresh fracture. It crumbles slowly in water. Sp. gr. 2·365. Analyses I and II. 7·95 per cent. of the water is only expelled at a red heat, hence the formula $H_4CaAl_4Si_9O_{27} + 15H_2O$.

Nontronite forms a sulphur-yellow incrustation on graphite. Sp. gr. 2·145. Analyses III and IV give the formula $Fe_2Si_3O_9 + 5H_2O$.

Kaolinite occurs with graphite in limonite, limestone and hæmatite. Analyses V—VII of white material; in VI and VII there are traces of CO_2, and in VII also P_2O_5.

	SiO_2.	TiO_2.	Al_2O_3.	Fe_2O_3.	CaO.	MgO.	$(K,Na)_2O$.	H_2O.	Total.
I.	48·50	—	18·90	0·42	5·12	0·13	—	27·40	100·47
II.	48·37	—	19·48		4·98	0·19	—	27·49	100·51
III.	41·78	—	35·30	0·86	0·92	0·40	—	20·68	99·94
IV.	41·65	—	36·24		1·01	0·37	—	20·74	100·01
V.	46·02	0·18	37·85	0·47	0·68	0·35	1·06	13·70	100·31
VI.	48·65	0·39	35·18	0·76	0·73	0·46	0·93	12·82	99·92
VII.	53·15	0·92	30·05	1·66	0·64	0·49	1·40	12·25	100·56

Pitticite occurs as stalactites in a shaft through limestone containing much mispickel. The stalactites attain a length of 10 cm., and consist of alternate shells of soft, yellow, and of hard, brown materials. Analyses VIII and IX give the formula

$$4FeAsO_4,Fe_2(OH)_4SO_4,6Fe(OH)_3,3H_2O.$$

Evansite occurs on limonite as a botryoidal coating of a white (analysis X), or of a yellowish colour (analysis XI). The analyses (traces of magnesia are also present) agree with those required for the usual formula $AlPO_4,2Al(OH)_3,6H_2O$.

	Al_2O_3.	Fe_2O_3.	CaO.	As_2O_5.	P_2O_5.	SO_3.	H_2O.	Insol.	Total.	Sp. gr.
VIII.	—	55·06	trace	26·13	—	4·64	14·29	0·12	100·24	2·475
IX.	—	55·19	trace	25·91	—	4·49	14·48	0·23	100·30	2·489
X.	39·22	0·87	0·41	—	18·02	—	41·47	0·15	100·14	1·874
XI.	38·05	1·92	0·23	—	18·48	—	41·29	0·44	100·41	1·937

L. J. S.

Analcite from Baku, Caucasus. By **Konstantin D. Glinka** (*Zeit. Kryst. Min.*, 1899, **31**, 517; from *Travaux Soc. Nat. Varsovie, Compt. rend., section phys. et chim.*, 1895–1896, No. 3).—A rock fragment from the blue clay of a mud volcano near Baku consists of pyroxene, a brown, isotropic substance, quartz and magnetite, together with analcite, which occurs either as a constituent of the rock or in cavities with celadonite. The analcite crystals are colourless and transparent, and are bounded by perfect faces of the form {211}; sections parallel to (100) are birefringent. The results of the analysis agree with those required for the usual formula $Na_2O,Al_2O_3,4SiO_2,2H_2O$.

SiO_2.	Al_2O_3.	Na_2O.	H_2O.	Total.
55·19	22·84	13·44	8·60	100·07

L. J. S.

Jadeite and Széchenyiite from Burma. By **József A. Krenner** (*Zeit. Kryst. Min.*, 1899, **31**, 502—504; from *Scientific Results of Count Béla Széchenyi's Journey in Eastern Asia*, 1877—1880, *Budapest*, 1897, **3**, 285—291, Hungarian).—Most of the specimens were bought in the market at Bhamo; the jadeite is usually white or greenish-white, but also pale grass-green and leek-green, and sometimes with emerald-green spots. The surfaces of the pebbles and fragments have a weathered crust, 1—10 mm. thick, which is either brown and compact, or light tile-red, and non-coherent. In thin sections, the larger, colourless fibres (1 × 10 mm.) show the optical characters of a monoclinic pyroxene. The prism cleavage angle = 93° 5′; optically positive, $Bx_a \wedge c' = 33° 34'$, $2V = 71° 56'$, $\beta = 1{\cdot}654$ (Na). Analysis by J. Loczka gave the results under I, agreeing with those required for the formula $NaAl(SiO_3)_2$. The emerald-green spots contain a little iron and traces of chromium.

	SiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	MgO.	CaO.	K_2O.	Na_2O.	H_2O.	Total.	Sp. gr.
I.	59·77	24·10	0·54	—	0·29	0·62	0·17	13·61	0·36	99·46	3·323
II.	55·02	4·53	1·04	3·28	20·36	8·00	1·52	6·71	0·51	100·97	3·033

Széchenyiite is the name given to a dark brownish-green, foliated mineral embedded in greenish jadeite; it resembles diallage in appearance, but is shown to have the characters of an amphibole. The fibres have a prism cleavage angle of 56° 8′, and an extinction angle on (010) of 16° 16′; the pleochroism is feeble. Splinters easily fuse and give a strong yellow coloration to the flame. Analysis by J. Loczka gave II, agreeing with $2Na_2O,10MgO,3CaO,Al_2O_3,16SiO_2$. In some of the jadeite specimens are light greenish-yellow or colourless fibres of amphibole. This occurrence of amphibole explains the presence of magnesia and lime shown in some analyses of jadeite.

L. J. S.

Auerbachite, and the Rock in which it occurs. By Pavel V. von Jereméeff (*Zeit. Kryst. Min.*, 1899, **31**, 512; from *Bull. Acad. Sci. St. Pétersbourg*, 1897, **7**, 89—95).—An examination of auerbachite from near Mariupol, Gov. Ekaterinoslaff, shows that the mineral in its chemical, physical and geometric characters is identical with zircon. The excess of silica is due to the large numbers of enclosed ægirite needles. The crystals are sometimes altered to a white, porous material resembling porcelain.

The rock in which auerbachite occurs is shown not to be a quartz-schist, but to be a pure, schist-like aggregate of albite crystals with a few small ægirite crystals. Analysis gave:

SiO_2.	Al_2O_3.	Fe_2O_3.	CaO.	MgO,K_2O.	Na_2O.	Loss on ignition.	Total.
60·29	21·39	3·07	0·46	traces	12·30	0·67	98·18

L. J. S.

Microcline pseudomorphous after Adularia from the Altai Mountains. By Pavel V. von Jereméeff (*Zeit. Kryst. Min.*, 1899, **31**, 506; from *Verh. k. russ. min. Ges.*, 1897, [ii], **35**, Protokolle, 55—56).—The pseudo-crystals have bright, smooth faces, and are twinned according to the Manebach and Baveno laws; they consist of an aggregate of microcline individuals. Analysis by P. Nikolaéeff gave:

SiO_2.	Al_2O_3.	Fe_2O_3.	CaO,MgO.	K_2O.	Na_2O.	Loss on ignition.	Total.
63·41	18·60	0·57	traces	10·09	6·01	0·54	99·22

L. J. S.

Clay from Russia. By Wladimir Alexéeff (*Zeit. Kryst. Min.*, 1899, **31**, 509; from *Verh. k. russ. min. Ges.*, 1897, [ii], **35**, Protokolle, 63).—A clay from Kossoi Brod on the Chusovaya (Tschussowaja) river, Perm, is seen, under the microscope, to consist of irregular, transparent, and birefringent lamellæ. Analysis shows it to be near pyrophyllite. It contains 38·6 per cent. of quartz.

SiO_2.	Al_2O_3.	Fe_2O_3.	CaO.	MgO.	K_2O.	H_2O.	Total.
67·60	22·22	1·65	0·18	0·28	3·93	5·37	101·23

L. J. S.

Rock Analyses. By EDMOND BONJEAN (*Bull. Soc. Chim.*, 1899, [iii], 21, 691—693).—Details of work already published (this vol., ii, 500). N. L.

Meteorite from Zavid. By CARL HÖDLMOSER (*Tsch. Min. Mitth.*, 1899, 18, 513—517).—The bulk analysis of the stone which fell at Zavid, in Bosnia, gave:

SiO_2.	Al_2O_3.	Fe.	FeO.	CaO.	MgO.	Na_2O.	K_2O.	H_2O.	S.	Total less O for S.
41·90	1·92	0·15	27·40	4·60	22·79	1·05	0·41	0·39	1·01	101·11

Also traces of cobalt, nickel and manganese. Sp. gr. 3·5241. The metallic iron was estimated from the amount of hydrogen liberated when the material was treated with acid; a description and figure are given of the apparatus used in the estimation. L. J. S.

Analysis of Meteoric Iron. By O. SJÖSTRÖM (*Mitth. naturwiss. Ver. f. Neu-Vorpommern u. Rügen*, 1899, **30**, 1—29).—The author gives the details of the methods of separation and estimation used by him in the analysis of meteoric irons. The methods are essentially the same as those outlined by Cohen (Abstr., 1893, ii, 20), and several of the author's analyses are given in recent papers by Cohen. L. J. S.

Meteoric Irons. By EMIL W. COHEN (*Ann. k.k. naturhist. Hofmus. Wien*, 1899, 13, 473—486).—A review of the literature and notes concerning the structure are given of various meteoric irons; the following new analyses by O. Sjöström are given:

Shingle Springs, El Dorado Co., California.—In the large proportion of nickel and in the bright etching spots, this resembles the Cape of Good Hope, Iquique, and Kokomo irons (this vol., ii, 307). Sp. gr. 7·8943. Analysis gave the results under I, corresponding with the following mineralogical composition: Nickel-iron, 97·65; nickel-iron phosphides, 2·21; troilite, 0·14.

Magura, Hungary.—The angular fragments left after dissolving the iron in very dilute hydrochloric acid gave, on analysis, the results under II. As in other irons, this material consists mainly of kamacite, with perhaps a little tænite.

	Fe.	Ni.	Co.	Cu.	Cr.	C.	P.	S.	Total.
I.	82·21	16·69	0·65	0·02	0·02	0·03	0·34	0·05	100·01
II.	92·54	6·40	0·73	—	—	0·00	0·09	—	99·76

Previous analyses (Abstr., 1893, ii, 20) of tænite (a nickel-iron) show the presence of small amounts of carbon. New determinations made on tænite from the Toluca and Glorieta Mt. irons gave 0·22 and 0·12 per cent. of carbon respectively. L. J. S.

Red Rain Dust. By THOMAS STEEL (*Rept. Australian Assoc.*, 1898, 7, 334—335).—On December 27th, 1896, there occurred over Melbourne and a considerable area of Victoria an unusually heavy fall of dust of a red colour, which was carried down by accompanying rain. Analysis of this dust (dried at 110°) gave:

Soluble SiO_2.	Fe_2O_3.	FeO.	Al_2O_3.	CaO.	SO_3.	Insol. and diff.	Loss on ignition.
0·75	4·68	0·50	15·16	1·36	0·62	[66·23]	10·70

The loss on ignition includes: H_2O, 6·08; N, 0·30, and organic matter. This composition agrees with that of an ordinary surface soil derived from volcanic rocks. Under the microscope, diatoms, lepidopterous scales, quartz, and garnet have been detected in the material. L. J. S.

Mineral Waters of Mont Dore. By F. Parmentier (*Compt. rend.*, 1899, **128**, 1408—1409).—Mineral waters from neighbouring springs generally contain the same constituents, but the water taken from borings in the neighbourhood of Mont Dore presents no points of similarity with samples obtained from other sources in the same district. It contains a comparatively large amount of sodium chloride and notable quantities of sodium arsenate, iron being entirely absent.
G. T. M.

Mineral Waters containing Fluorine. By F. Parmentier (*Compt. rend.*, 1899, **128**, 1409—1410).—In reply to Lepierre (this vol., ii, 602), the author states that his remarks on the occurrence of fluorides in mineral waters refer to the special case of water from Mont Dore and St. Honoré-les-Bains (compare this vol., ii, 501).
G. T. M.

Analysis of Waters from the Tougourt-Ouargla District of the Sahara Desert. By E. Lahache (*J. Pharm.*, 1899, [vi], **9**, 477—482).—Analyses of water from the following places in the Sahara:—Tougourt, Bled et Amax, El-Fetir, H. Messaoud, El-Hadjira, H. Dahane, H. Debiche et Strifigi, Donionidi, N'Gonça, Ouargla.
H. R. Le S.

Physiological Chemistry.

The Effect of Compression of one Lung on the Respiratory Gas Exchange. By Vaughan Harley (*J. Physiol.*, 1899, **25**, 33—48).—The experiments were made on dogs, morphine being administered to prevent muscular action. The compression of one lung (right or left) is followed by an increased rate of breathing as a rule, and always by an increase in the quantity of air breathed, of oxygen absorbed, and of carbonic anhydride eliminated; the respiratory quotient is, as a rule, not altered.

The cause of the increase in gas exchange is not due to the increased rate of breathing, for the latter did not always occur; nor is it due to an increase of body temperature, or to displacement of the heart. A possible explanation is, that carbonic anhydride is a secretion of the alveolar epithelium (Bohr), and that carbonic anhydride acts as a stimulant to its own secretion. W. D. H.

Pancreatic Diabetes. By Ivor Ll. Tuckett (*J. Physiol.*, 1899, **25**, 63—68).—Gaglio found that extirpation of the pancreas was not followed by glycosuria if the thoracic duct was ligatured. This, if true, proves that something enters the circulation by the thoracic lymph which normally is destroyed by the pancreas, and which, in the absence of the pancreas, causes glycosuria. But Lepine and Biedl maintain that ligature of the thoracic duct increases the glycosuria caused by excision of the pancreas. Ligature or fistula of the left thoracic duct in dogs is in itself a cause of glycosuria (Biedl). The present communication is a preliminary account of experiments which support the following supposition, and so reconcile the above opposing statements :—Glycosuria, which follows interference with the thoracic duct, is but a mild form of pancreatic diabetes, if we assume that the pancreas has an internal secretion (t) which enters the circulation constantly *viâ* the thoracic lymph ; and also that a toxic substance (t') capable of causing glycosuria, if not neutralised by t, is absorbed from the intestine during digestion *viâ* the lymph stream. It must also be assumed that the thoracic lymph contains a large quantity of t' during digestion, but none at other times, whereas only a small quantity of t is ever present in the thoracic lymph, but the blood always contains a relatively large quantity, as it is continually accumulating there.

If the thoracic lymph from a fasting animal is injected into the portal circulation of another animal, there is no hyperglycæmia or glycosuria ; but if the lymph injected be from a digesting animal, the hypothetical t' acts on the liver cells deleteriously and produces hyperglycæmia and glycosuria. If the lymph is injected into the general blood stream, the effect is less marked, namely, t' is then partially neutralised by t before it acts on the liver. If the venous return from the pancreas is impeded by air bubbles, the secretion of t is checked, and glycosuria is more marked. W. D. H.

The Behaviour of Benzoyl Peroxide and Calcium Peroxide in the Digestive Canal of Dogs and Men. By Marcellus Nencki and J. Zaleski (*Zeit. physiol. Chem.*, 1899, **27**, 487—506).—The administration of such drugs as calomel and castor oil was empirical previous to the discovery of the true nature of putrefaction. The absolute disinfection of the alimentary canal is not possible, or even advisable; the use of antiseptics is limited because of their harmful effects on the alimentary canal. After the discovery that pancreatic juice will decompose, not only fats, but also many salts of the aromatic series, into their components, the use of such substances as salol (which is resolved into salicylic acid and phenol) became possible. The present research relates to the use of oxygen, not in the free state, but by the decomposition of peroxides. The use of organic peroxides dates from the time of Brodie (1863). Benzoyl peroxide is undoubtedly decomposed in the intestine ; hippuric acid appears in the urine, although not in amount sufficient to account for half of the drug given. Experiments with artificial digestion confirmed this ; but the drug has little or no effect on the amount of ethereal hydrogen sulphates in the urine. Better results followed the use of calcium peroxide; it appears to be more readily decomposed; it has no harmful effects; in dogs, the ethereal hydrogen sulphates are lessened, and the indican completely disappears; its effect is transitory; in man, especially in the acid dyspepsia of children, it is beneficial. W. D. H.

Physiological Effects of 'Peptone' when Injected into the Circulation. By William H. Thompson (*J. Physiol.*, 1899, **25**, 1—21).—This is a continuation of results already published (this vol., ii, 604), and relates to the influence of the constituents of 'peptone' on the vessels of the spleen, liver, and limbs, all of which were investigated by the plethysmographic method. The vessels of the spleen share, to a moderate extent, the dilatation which produces the fall of blood pressure. Vaso-mobility, as tested by stimulation of the splanchnic nerves, is diminished, but to a less degree than in the intestinal, although in a greater degree than in the renal, district. The vessels of the liver are enormously dilated, the accumulation of blood there exceeding that in the intestines. The liver, in fact, probably plays the part of a safety receptacle to the heart. There is also a great depression of vaso-mobility. The effect on the limb-vessels is very slight, even less than on those of the kidneys.

Of the constituents of Witte's peptone, proto- and hetero-proteose are the most effective in producing these results. Deuteroproteose and purified peptone have comparatively little influence.

W. D. H.

The Effects on Blood and Urine of the Intravenous and Subcutaneous Injection of Various Carbohydrates. By Frederick W. Pavy (*J. Physiol.*, 1899, **24**, 479—517).—The sugar normally present in blood does not consist exclusively of dextrose, its reducing power compared with that of dextrose being 75 : 100. The small amount of sugar in normal urine has an even smaller reducing pover. The amount of sugar found in the blood collected immediately after the injection of large doses (in rabbits) is greater in the case of the saccharoses than in that of the hexoses. The highest figures (21—24 per 1000) occur after cane sugar; galactose and dextrose give respectively 11—12 and 14—15 per 1000. After small doses, the same disparity is not observable. The saccharoses comport themselves as unserviceable foreign matter and are speedily cast out into the urine. The results obtained with maltose are ambiguous; after intravenous injection, they correspond with those of lactose and cane sugar; after subcutaneous injection, the results correspond with those of the hexoses. The hexoses show a low degree of elimination; galactose escapes more freely than lævulose or dextrose, between which there is not much difference. Dextrose appears to undergo an alteration; after injecting a large quantity, it is found in both blood and urine; injected in less quantity, the reducing power of the sugar in the blood and still more of the sugar in the urine is far less than that of dextrose. In the case of galactose, and probably also in that of lævulose, there is no such change.

Glycogen injected intravenously causes a rise of sugar in the blood, and the elimination in the urine of a considerable amount of a product with low reducing power.

Considerable stress is laid on the generalisation that the sugars susceptible of application by the body are those which ferment with yeast; a sugar which yeast can appropriate is likewise susceptible of appropriation by living matter of another kind, not necessarily that of the liver exclusively, but by the protoplasmic matter of the body generally. W. D. H.

Elimination of Nitrogen and Phosphorus during Assimilation. By WILLIAM ŒCHSNER DE CONINCK (*Compt. rend.*, 1899, **129**, 223—224).—Observations made in 1892 and 1893 on infants fed on milk show that the ratio of phosphoric anhydride to nitrogen, N/P_2O_5, in the urine varies from 1/5·2 to 1/10·4, and the results are practically identical with those recently described by Keller.

C. H. B.

Further Proofs of the Origin of Uric Acid from Nuclein Compounds and Derivatives. By WILLIAM J. SMITH JEROME (*J. Physiol.*, 1899, **25**, 98—104).—Ingestion of pig's pancreas, herring's roe, or Liebig's extract increases the excretion of uric acid. The evidence of the origin of the latter from nucleins does not therefore depend on thymus feeding alone. Any disproportion between the excretion of uric acid after flesh diet and the amount of nucleins contained in muscle is probably to be explained by the presence in such diet of alloxuric bases, and especially of hypoxanthine, in sufficient quantity to account for the rise produced. The presence of these bases in flesh probably accounts for the early rise in uric acid after a meal, and will also account for the increase found when pepsin-hydrochloric (nuclein free) extracts of the thymus are taken. Fresh experiments are given showing a rise of uric acid after taking pure nucleins. There is, in fact, no evidence that uric acid can arise in man independently of a substance containing an alloxuric (purine) group. W. D. H.

Results of Administration of Indole. By EYVIN WANG (*Zeit. physiol. Chem.*, 1899, **27**, 557—574).—Indole was first recognised as the source of indican in the urine by Jaffé (*Centr. med. Wiss.*, 1872, 1, 2), and urinary indican was shown to be an ethereal sulphate by Baumann (*Zeit. physiol. Chem.*, 1877, **1**, 67). Estimation of indican now being possible by the author's method, the present research was undertaken to determine the quantitative relationship of indole given by the mouth, and the indigo of the urine, in dogs. The following results were obtained:—The indole of the alimentary canal is excreted by the urine within 24 hours; 1 gram of indole is sufficient to cause symptons of poisoning in a medium sized dog; this has been denied by some previous observers (Baumann and Brieger); the quantity of ethereal hydrogen sulphates excreted is smaller than that which would correspond with the amount of indole given; about half of this amount of indole is passed as indigo-forming substance; ethereal hydrogen sulphates other than potassium indoxyl sulphate are formed; the excretion of indigo and of ethereal hydrogen sulphates is not constant on a fixed diet in the normal condition; there is also no constant relationship between the indican and the ethereal hydrogen sulphates; cooking the food makes no difference. W. D. H.

Pentoses in the Urine. By Ernst Salkowski (*Zeit. physiol. Chem.*, 1899, **27**, 507—539).—The reactions examined for the detection of pentose in the urine were:—(1) The Tollens reaction with phloroglucinol and hydrochloric acid; (2) the Tollens reaction with orcinol and hydrochloric acid; (3) the test with aniline acetate paper; (4) the occurrence of furfuraldehyde after distillation with hydrochloric acid; and (5) the preparation of the osazone. Each test is described with full details and the precautions that are necessary. After the use of certain drugs such as menthol and chloral, these tests, especially the first, may be positive without the presence of pentose; glycuronic acid also may be a source of error. In the presence of dextrose, pentose can still be detected, after the removal of the sugar by fermentation. Three cases of pentosuria are described. The origin of pentose in the body is discussed, and the view that it originates from the nucleoproteids in the pancreas is dismissed. It is regarded as probable that it originates from hexoses. W. D. H.

Reducing Power of Urine. By Henri Hélier (*Compt. rend.*, 1899, **129**, 58—60).—The author determines the reducing power of urine by mixing 10 c.c. of the liquid with 10 c.c. of concentrated sulphuric acid and adding a solution of potassium permanganate (6·36 grams per litre) until a permanent rose tint is produced. An estimation of the urea is also made in order that the reducing power may be expressed with reference to urine of normal concentration containing 2 per cent. of urea. If n is the number of c.c. of potassium permanganate solution used and m the number of grams of urea per litre, then the reducing power $P = 20n/m$. Normally, P ranges from 12·5 to 15, but with pathological urine higher or lower values are found, according to the nature and intensity of the disease. N. L.

Toxicity of Normal Urine. By Wilmot P. Herringham (*J. Pathol. and Bacteriol.*, 1899, **6**, 158—179).—The experiments recorded were made on rabbits. Normal human urine is undoubtedly fatal when injected intravenously into these animals. The fatal dose varies very considerably, and is not the fixed quantity upon which Bouchard deduced his 'mathematical' theories on the subject. These theories are subjected to criticism, and when tested by experiment invariably fall to the ground. The difference between morning and evening urine, upon which Bouchard established his well-known theory of sleep and waking, does not exist. Bouchard apparently never made any chemical examination of urine, or at least never published any results. The symptoms that follow injection of the urine are contraction of the pupils, drowsiness, twitchings and convulsions, failure of respiration and heart. The analyses published show that the toxicity and amount of potassium salts vary together. This supports the view, which has already been advanced by numerous investigators, that the toxic agents are the potassium salts; they will account for all the symptoms except the contraction of the pupils. W. D. H.

Proteids of Muscle. By GEORGE N. STEWART and TORALD SOLLMAN (*J. Physiol.*, 1899, **24**, 427—459).—The method of fractional heat coagulation can be usefully employed in the separation and quantitative investigation of the muscle proteids. The two principal proteids of muscle are paramyosinogen, a typical globulin coagulating from 45—50°, and an atypical globulin, myosinogen coagulating at about 56 to 63°. Halliburton's myoglobulin is regarded as part of the myosinogen. Von Fürth's soluble myo-fibrin is regarded as part of the paramyosinogen. Both proteids pass readily, either in the muscle itself or in saline extracts, into an insoluble modification, myosin; myosinogen first passing readily into a modification similar to or identical with paramyosinogen. As a rule, paramyosinogen is more abundant in saline (5 per cent. magnesium sulphate) extracts than myosinogen; extracts of muscle made with water contain more myosinogen. No marked quantitative differences in the relative amount of the two proteids could be established in the muscles of different animals, in different muscles of the same animal, or in *rigor mortis*. The method of estimation is not capable of detecting minute differences.

The coagulation of the proteids is accompanied with increase of acidity; this confirms what Halliburton originally stated, and von Fürth denied.

Certain facts indicate that *rigor mortis* is associated with the precipitation of paramyosinogen and myosinogen; still the properties of the proteids in extracts do not afford a complete explanation of the production and resolution of rigor. W. D. H.

Effect of Removal of the Proteid on the Molecular Concentration and Electrical Conductivity of Muscle Extracts. By GEORGE N. STEWART (*J. Physiol.*, 1899, **24**, 460—463).—The results given show that the conductivity is increased after removal of the proteids; the globulins of muscle extracts (which probably would hold salt more firmly or in greater amount than albumins) depress the conductivity in a greater degree than the proteids of serum or hæmoglobin. No constant difference is as yet made out between the various proteids of muscle extracts. W. D. H.

Nature of the Action of Antitoxins. By LOUIS COBBETT (*J. Pathol. and Bacteriol.*, 1899, **6**, 193—219).—The experiments recorded were performed with the toxin and antitoxin of diphtheria. They follow very much on the lines of those previously published (this vol., ii, 234) by Martin and Cherry, and the results obtained confirm their view, namely, that the interaction of toxin and antitoxin is a chemical one; neutralisation takes place *in vitro*, provided time is allowed, and the intervention of the living cells of the body is not necessary, as Buchner maintains. W. D. H.

Presence in the Animal Organism of an Enzyme Capable of Reducing Nitrates. By E. ABELOUS and ERNEST GÉRARD (*Compt. rend.*, 1899, **129**, 56—58).—The filtered aqueous extracts of the liver, kidney, suprarenal capsules, lungs, testes, intestines, ovary and submaxillary gland, pancreas, spleen, striated muscle, and brain of the horse possess the property of reducing alkali nitrates to nitrites, the activity of the various organs decreasing in the order indicated. The reduction is in all probability due to the action of an enzyme, since it does not occur if the extracts have been previously heated at 100°, but is not affected by the presence of antiseptics. The activity of the enzyme varies with the temperature, being very feeble at 0°, attaining a maximum between 20° and 40°, and ceasing altogether at 72°. N. L.

Presence of a Soluble Reducing Enzyme in the Animal Organism. By E. Abelous and Ernest Gérard (*Compt. rend.*, 1899, **129**, 164—166).—An aqueous or glycerol extract of the kidney of the horse contains an enzyme which is capable of reducing nitrates to nitrites; if the extract is boiled, the ferment is destroyed, and the liquid no longer reduces nitrates. Antiseptics like chloroform, thymol, essence of cinnamon, and sodium fluoride do not destroy the reducing power of the extract, but mercuric chloride (1 in 2000) does. The amount of nitrite formed attains a maximum at a temperature of 40—45°, above this it gradually decreases and becomes *nil* at 71—72°. A mixture of 100 c.c. of the extract, 8 grams of potassium nitrate, and 1 c.c. of chloroform was placed in each of three flasks, the air in two of which was displaced by hydrogen and carbonic anhydride respectively. After standing for 24 hours at 42°, the flask, the air in which had been displaced by hydrogen, contained the greatest amount of nitrite, and the flask with the carbonic anhydride by far the least. The addition of sodium carbonate to the extract favours the formation of nitrite. The extract is inactive after filtration through unglazed porcelain.

The enzyme reduces, not only potassium nitrate, but also ammonium nitrate, it decolorises methylene-blue and seems to reduce butyric acid to butyraldehyde. H. R. Le S.

Physiological Action of the Alkaloids derived from Anhalonium Lewinii. By Walter E. Dixon (*J. Physiol.*, 1899, **25**, 69—86).—*Anhalonium Lewinii* is a small cactus, locally known as "mezcál." A drink prepared from it has remarkable physiological properties, and is used by certain tribes of Mexican Indians in their religious ceremonies. E. White has confirmed Heffter's results (Abstr., 1896, i, 267) with reference to the existence of the four alkaloids. Mezcaline, anhalonidine, anhalonine, and lophophorine are all crystalline except the last. The physiological action of each is practically the same. Experiments were made on dogs, cats, and men.

There is no action on the skin, an increased flow of saliva, occasionally vomiting, constipation (in man with small doses), and diarrhœa, with blood-stained stools (in animals with large doses). There is no effect on the blood; there is slowing of the heart and fall of blood-pressure; the effect on the heart is not neutralised by atropine; the vagus is paralysed, the return to normal blood pressure is usually quite sudden. There is no effect on the muscles. Respiration is affected only in toxic doses; it becomes quicker and shallower, and death occurs from failure of the respiratory centre. In animals, there is first increased reflex activity, then paralysis, which is central in origin. In man, there is a preliminary stage of excitement, followed by one of intoxication, which is very much like that caused by alcohol. There are also a number of interesting subjective sensations: a feeling of 'dual existence,' an increased sensitiveness to odours and to music; but the visual sensations are the most marked; there is a kaleidoscopic display of colours; these can be seen with either eye, and must be of central origin. The colouring of external objects is intensified. The urine contains the drugs, and there is some diuresis. Lophophorine is the most powerful of the alkaloids, but mezcaline is most effective in producing colour visions. W. D. H.

Mineral Composition of the New-born Child, and Bunge's Law. By Louis Hugounenq (*Compt. rend.*, 1899, **128**, 1419—1421. Compare this vol., ii, 503).—Bunge's law, which states that the epithelial cells of the mammary glands secrete, from the mineral salts of the plasma, the exact amounts of inorganic substances necessary for the development of the offspring, holds in the case of the cat, dog, and rabbit. Analyses of the mineral skeleton of the new-born child and of the ash of human milk however, show that these differ widely in composition, and hence the law is not applicable to the human species. It is probable that the law holds only for those mammals whose osseous tissues are largely developed during the period of lactation; this is not the case in man, and hence the mother's milk is a less important factor in the development of the human offspring than in that of other mammals. G. T. M.

Chemistry of Vegetable Physiology and Agriculture.

Amount of Ash and Cellulose Present in Posidonia Caulini. By Felix Chancel (*Bull. Soc. Chim.*, 1899, [iii], **21**, 740—742).—The seaweed, *Posidonia caulini*, after being washed with water, contains 10·9 per cent. of ash, calculated on the dry sample, consisting principally of salts of calcium and magnesium; the cellulose, estimated by digesting the dry plant alterately with bromine water and boiling dilute caustic soda, amounts to 39·5 per cent. Since the amount of cellulose remaining after boiling the seaweed with 50 per cent. aqueous caustic potash for 2½ hours under a pressure of 15 lbs. per square inch was 15·3 per cent., and wheat-straw under the same conditions yields 17·9 per cent., it appears probable that the weed, which is very plentiful on the southern coasts of France, can be utilised for paper-making.
W. A. D.

Amount of Pentosans in Vegetable and other Substances. By A. Menozzi (*Ricerche Lab. chim. agrar. R. Scuola Sup. Agric. Milan*, 1898, 247—249).—The following percentage amounts of pentosans were found in the dry matter of the different substances:—Mulberry leaves, 5·00 (average of five analyses); excrement of silkworms, 9·48; compressed yeast, 2·18; edible fungi (*Boletus edulis*), 1·93; *Penicillium glaucum*, none. Mulberry leaves and the excrement of silkworms contained 11·16 and 18·07 per cent. of cellulose respectively.

N. H. J. M.

Oxidising Enzyme from Hellebore. By PH. VADAM (*J. Pharm.*, 1899, [vi], **9**, 515—516).—The stem and fresh leaves of this plant contain an oxydase similar to those studied by Bourquelot and Bertrand, Lépinois, and others. Its ash contains iron, but the presence of manganese is not proved. H. R. LE S.

Secretion of Enzymes. By DIENERT (*Compt. rend.*, 1899, **129**, 63—64. Compare this vol., ii, 442).—If a yeast which ferments lactose is grown in different portions of a nitrogenous, nutritive medium containing (*a*) glucose, (*b*) galactose, and (*c*) lactose, and the yeasts subsequently separated, dried, and extracted with water, three solutions containing lactase are obtained, the relative activity of which, in hydrolysing lactose, are represented by the numbers 1, 5, and 6 respectively. The most active solution, however, hydrolyses not more than 6 per cent. of lactose. It thus appears that the acclimatisation of a lactose yeast to galactose is accompanied by an increased secretion of lactase. Similarly, the acclimatisation of bottom yeasts is found to be associated with the production of melibiase. N. L.

Decomposition of Glucosides by the Action of Moulds. By KONSTANTIN A. PURIEWITSCH (*Chem. Centr.*, 1899, i, 702—703; from *Ber. Deut. bot. Ges.*, **16**, 368—377).—*Aspergillus niger* decomposes salicin into glucose and saligenin, the former being absorbed by the mycelium, and when solutions of helicin, arbutin, coniferin, æsculin, phloridzin, or hesperidin are covered with the mycelium, these glucosides undergo the same decompositions as emulsin effects. The salicylaldehyde formed by the decomposition of helicin kills the mycelium. *Aspergillus glaucus* and *Penicillium glaucum* behave like *A. niger*, but whilst emulsin or the extract from any of these moulds decomposes amygdalin into glucose, benzaldehyde, and hydrocyanic acid, neither benzaldehyde nor hydrocyanic acid is formed by the action of the living mycelium and the amygdalin solution in this case does not reduce Fehling's solution. The amygdalin is assimilated by the mycelium, with formation of ammonia.

In all cases, the glucosides are decomposed into glucose, which is assimilated by the mould and benzene derivatives which are either assimilated or left in solution. This action is effected by means of emulsin, which diffuses from the mycelium. Apparently an enzyme which inverts the sugar is also present. The benzene derivative is only attacked when all the sugar has been used, and similarly in culture solutions containing glucosides and carbohydrates, the former are hydrolysed only when a certain amount of the latter has been appropriated by the mould. E. W. W.

Influence of Mineral Constituents of Water on the Composition of Worts and Yeast Ash. By FRANCIS E. LOTT (*Bied. Centr.*, 1899, **28**, 503—504; from *D. Bierbrauer*, 1898, *Beibl.* No 12).—Water containing calcium sulphate extracts less phosphates and resin, but as much nitrogen as soft water; the fermentability is diminished and the beer produced has a better taste and a lighter colour. Magnesium sulphate diminishes the amount of extract, but not the percentage of phosphates and nitrogen in the extract; when large amounts are present, the beer has a somewhat rough, hard taste. Sodium chloride causes a separation of phosphates and increases the amount of maltose. Calcium chloride increases the nitrogen in the worts, and diminishes the total maltose and the production of yeast. Nitrates cause diminished amounts of extract, impede fermentation, and readily produce beer of a darker colour. Sodium, potassium, and magnesium carbonates check the diastatic power, increase the amounts of proteids, dissolve the hop-resin, and so produce dark-coloured beer with a rough taste. Hydrogen calcium carbonate diminishes the yield of extract, separates phosphates, and dissolves the resin.

The mineral matters in water influence the composition of yeast, and if the effect is at first harmless, injury may be caused as time goes on; on the other hand, the yeast may become acclimatised and eventually be less affected by the mineral matter. Yeast from worts in soft water was found to contain most of the phosphoric acid (93·9 per cent. of the ash) as potassium salt, whilst the ash of Burton yeast contained considerable amounts of magnesium and calcium phosphates (21·0 and 13·6 per cent.) as well as the potassium salt (63·1 per cent.). N. H. J. M.

Experiments with Nitragin. By Hjalmar von Feilitzen (*Mitt. Ver. Förd. Moorkultur*, 1898, **16**, 323—324).—Nitragin experiments made in 1896 with grey peas growing on new peat-land showed an increase of about 55 per cent. of straw and 116 per cent. of corn under the influence of inoculation. More recent experiments are described in which grey peas and bastard clover were grown on three plots of 2 acres each, the nitragin being applied to the seed and to the soil respectively. As before, the soil was uncultivated peat-land. The following amounts of produce (in kilos.) were obtained:

	Not inoculated.	Seed inoculated.	Not inoculated.	Soil inoculated.
Grey peas (dried)...	270	1220	100	1340
Clover (green)	60	2130	0	1020

N. H. J. M.

Influence of Ether on Germination. By C. O. Townsend (*Expt. Stat. Record.*, 1899, **10**, 1048; from *Proc. Amer. Assoc.*, 1898, **48**, 409—410).—Seeds were soaked in pure water for 24 hours and then transferred to air-tight chambers containing respectively 1, 2·5, 5, and 10 c.c. of ether in 100 c.c. of water. One c.c. of ether slightly expedited germination, but somewhat retarded the subsequent growth. Ten c.c. of ether prevented germination, and in 2 weeks seemed to kill the seeds; when, however, the seeds were removed after 7—10 days, they germinated readily Similar results were obtained with spores on gelatin plates. N. H. J. M.

Behaviour of Calcium Oxalate during the Growth of Vegetable Organs. By Gregor Kraus (*Bied. Centr.*, 1899, **28**, 458—459; from *Flora*, 1897, **83**, 54—73, and *Bot. Centr.*, 1897, **69**, 384).—On growing roots of *Rumex obtusifolius* in pure quartz sand, with and without addition of chalk, it was found that, whilst in presence of chalk there was either no change or else a gain of calcium oxalate in the plants, there was a not inconsiderable loss of oxalate in the plants grown without lime; in some cases, the loss of oxalate diminished to the same extent as the other reserve substances. The oxalate had evidently been utilised to supply the lime necessary for the development of the growth above ground, and it is concluded that this occurs under normal conditions when lime becomes necessary.

In the case of the oxalate in the rind of bushes and trees, it was found that the amount diminished during the formation of buds.

The fact that, in *Cactaceæ*, the amount of oxalate is greatest in the older parts would seem to indicate that it is not used up, but inasmuch as the crystals are mostly in the living parenchyma, it seems possible that the oxalate might be available if required.

A number of experiments made with a variety of vegetable acids showed that the acids present in the cell-sap have the power of dissolving calcium oxalate. N. H. J. M.

Formation of Alcohol and Carbonic Anhydride, and Absorption of Oxygen in Plant Tissues. By Marcellin P. E. Berthelot (*Compt. rend.*, 1899, **128**, 1366—1370. Compare Abstr., 1895, ii, 124).—In order to demonstrate conclusively the existence of alcohol in the organs of the living plant, it is absolutely necessary to operate on tissues recently removed with as little mutilation as possible, otherwise appreciable quantities of this substance may be produced by subsequent fermentative changes.

Freshly-cut blades of wheat were introduced into a tared flask and heated to 94° after displacing the air by a current of hydrogen. The carbonic anhydride and alcohol were driven off, and the former estimated by potash absorption. The experiment was repeated with hazel leaves, and a large quantity of material was employed in order to ascertain the nature of the alcohol; in this case, the distillation was conducted in a current of steam, and from 10 kilos. of leaves, about 10 grams of alcohol were obtained, consisting chiefly of the ethylic derivative, together with appreciable quantities of its higher homologues, and a trace of some camphor-like substance; methylic alcohol was not detected.

These results indicate that the tissues of wheat and hazel grown under normal conditions contain small quantities of alcohol, this substance being produced by reactions similar to those which give rise to methylic alcohol in certain other plants. No simple relationship could be traced between the amounts of alcohol and carbonic anhydride; the evolution of gas continues for several hours, and is due to changes which do not involve the formation of alcohol, and the quantity increases when air is admitted during distillation. It follows from this that the variation in the ratio between the carbonic anhydride produced and oxygen absorbed ("respiratory coefficient") cannot depend on the formation of any one compound such as ethylic alcohol.

G. T. M.

Production of Alpine Characters in Plants by Extreme Variations of Temperature. By GASTON BONNIER (*Compt. rend.*, 1898, **127**, 307—312).—Experiments on the influence of temperature on growth in the case of plants (clover, wood sage, groundsel, vetch, oat, and barley) capable of growing either at high or low altitudes. The plants were cultivated (1) in enclosures cooled to 4—9°; (2) under the normal summer conditions prevailing at Fontainebleau, the temperature ranging from 15—30°, and occasionally from 10—35°; (3) under conditions alternating between those of series 1 at night and those of series 2 in the daytime, the variations of temperature (4—35°) being comparable with those of Alpine regions; (4) at a uniform temperature of 16°. After an interval of two months (June 3rd to August 1st), the plants of series 3 were found to differ greatly from the others, being more stunted with smaller leaves, and more rapid flowering than even those grown at 4—9°. Hygrometric conditions are shown not to influence growth to any marked degree, and hence variation in temperature is the most important factor in the dwarfing of the alpine flora.

G. T. M.

[Respiration] of Plants Rendered Alpine Artificially. By GASTON BONNIER (*Compt. rend.*, 1899, **128**, 1143—1146).—The experimental conditions recorded in the preceding abstract were maintained until all the specimens of *Teucrium scorodonia* under investigation had blossomed and fructified (Sept. 16th). The differences presented by the plants are discussed, the most striking changes being found in the leaves. The assimilative power per unit of surface of the leaf showed a great increase in the specimen grown under alpine conditions, and a study of the gaseous exchange between the leaves and the atmosphere indicated that the following amounts of oxygen per sq. cm. of leaf area were evolved during half an hour by plants grown under the conditions 1, 2, and 3, recorded in the preceding abstract.

Series.	1	2	3 (Alpine conditions).
Wood sage (*Teucrium scorodonia*)...	0·200	0·265	0·271
Clover (*Trifolium repens*)	0·061	0·05	0·067

G. T. M.

Modification of Plant Respiration resulting from Variations of Temperature. By WLADIMIR PALLADIN (*Compt. rend.*, 1899, **128**, 1410—1411).—Etiolated stems of *Vicia faba* were weighed out in three portions; the first was kept at a medium temperature (17—20°), the second cooled to 7—12°, and the third heated to 36—37°; after several days, the three were brought to the same temperature, namely, 18—22°, and the amount of carbonic anhydride evolved from 100 grams was determined in each case. The stems which had been cooled evolved 40 per cent., and those which had been heated 53 per cent. more carbonic anhydride than those which had remained at the medium temperature. These experiments support the conclusions arrived at by Bonnier (preceding abstracts) with respect to the increase in the assimilating power of the leaves of plants grown under alpine conditions. G. T. M.

Improvement in the Chemical Composition of the Maize Kernel. By Cyril George Hopkins (*Univ. Illinois Agric. Expt. Stat. Bul.*, **55**, 1899, 205—240).—Whilst the composition of an ear of maize is nearly uniform throughout, different ears of the same variety often vary considerably in composition. It was therefore thought possible that, by selecting grain of known composition, crops might be obtained with high percentage of proteids, carbohydrates, or fat as desired. The results of field experiments commenced in 1896 show that this change can be effected. Selected seed containing a high percentage of proteids produced a crop containing 11·10 per cent. of proteid, whilst seed containing less proteid produced a crop containing 10·55 per cent. Greater differences were subsequently obtained.

In a similar manner, crops were obtained containing 5·15 and 3·99 per cent. of fat respectively. In six experiments, differences of 0·67 to 1·45 per cent. of fat were produced.

The percentage of carbohydrates varying inversely with the combined percentages of proteid and fat, carbohydrates are increased whenever the combined percentage of proteid and fat is decreased.

The amount of proteid in the seed varies chiefly with the proportion of glutinous layer in the kernel, whilst the amount of fat varies uniformly with the proportion of germ. It is thus both possible and practicable to select seed by mechanical examination and without chemical analysis. N. H. J. M.

Cultivation of Potatoes and Mangolds at Grignon. By Pierre Paul Dehérain (*Ann. Agron.*, 1899, **25**, 336—350).—Potatoes:—Different varieties of potatoes were manured with 30,000 kilos. per hectare of farmyard manure in addition to the previous crop of vetches which had been ploughed in. There were two plots for each variety of potatoes, one of which had produced a large, the other a smaller, yield of vetches. The average increase of potatoes (tubers), taking all varieties, due to the green manure, was 1·07 ton to each ton of vetches; as the vetches contain about 1 per cent. of nitrogen to 0·3 per cent. in potatoes, the green manure was by no means exhausted.

After discussing the amounts of produce and starch furnished by the different varieties grown under equal conditions, attention is drawn to the great importance of obtaining a change of seed.

Mangolds:—Experiments were made in which two varieties of mangolds, very similar in composition, were grown after vetches ploughed in. In addition to the green manure, all the plots except one had farmyard manure (30,000 kilos. per hectare); four plots received in addition sodium nitrate (200 kilos.), three were inoculated with nitrifying soil and four received no further treatment. The plot which had only green manure gave a very fair yield of roots (31,000 kilos). The application of nitrifying soil gave rise, on one plot, to greatly increased production of roots, the yield (59,300 kilos.) being higher than that of the plot which had nitrate; on another plot, however, nitrifying soil was without effect.

The amount of nitrogen removed by the roots (the leaves were returned) was about 170 kilos. per hectare, whilst the amount applied to the soil was 322 kilos. (in the form of dung, green manure, and nitrate), leaving 150 kilos. in the soil as organic nitrogen. The average amount introduced on the plots as green manure was 159 kilos. per hectare.

N. H. J. M.

[Analyses of Rothamsted Soils.] By **Arthur Goss** and **Harry Snyder** (*U.S. Dept. Agric. Div. Chem.*, *Bul.* 51, 1898, 73—79).—Partial analyses were made by the U.S. Department of Agriculture, and at several Agricultural Experiment Stations, of samples of surface soil (9 inches deep) from the following plots: Broadbalk Field (wheat), plots 3 (unmanured since 1843), 10 A (ammonium salts; N = 86 lb.), 11 (ammonium salts and superphosphate), and 13 (ammonium salts, superphosphate, and potash). Hoosfield (barley), plots 1 A (ammonium salts; N = 43 lb.), 2 A (ammonium salts and superphosphate), 3 A (ammonium salts and sodium, potassium, and magnesium sulphates), and 4 A (ammonium salts and complete minerals). The results are given as percentages in dry soil.

The soluble organic matter and nitrogen were determined by extracting with 3 per cent. ammonia and 3 per cent. sodium hydroxide respectively. Owing to the difficulties of the method, the results varied considerably; the highest and lowest are given here.

	Broadbalk Plot 3.			Hoosfield Plot 2 A.		
	Total N.	Humus.	N in humus.	Total N.	Humus.	N in humus.
Highest	0·12	3·29	4·92	0·12	2·93	3·14
Lowest	0·09	1·47	1·00	0·10	1·82	1·10
Mean	0·102	2·16	2·93	0·110	2·33	2·41

The total phosphoric acid was determined by the Goss method and by digestion with nitric acid; the total potash by the (1) Smith, and (2) hydrofluoric acid methods. Soluble phosphoric acid and potash were also determined.

	P_2O_5.		K_2O.				
	Total.	Sol. in	Total.		Soluble in.		
	(Mean).	*N*/5HCl.	Smith	HF.	*N*/5AmCl.	*N*/5$CaCl_2$.	*N*/5HCl.
Broadbalk Plot 3 ...	0·119	0·0039	1·20	1·38	0·0118	0·0110	0·019
Hoosfield Plot 2 A...	0·172	0·0357	1·29	1·30	0·0188	0·0097	0·016

The following average results, obtained with soils which have had no phosphates for 53 years (Broadbalk 3 and 10 A; Hoos. 1 A and 3 A), and with soils which received 350 lbs. of surphosphate each year (Broadbalk 11 and 13; Hoos. 2 A and 4 A), show that the methods give results in accordance with known facts.

Without phosphates.		With phosphates.	
Total P_2O_5.	P_2O_5 sol. in *N*/5HCl.	Total P_2O_5.	P_2O_5 sol. in *N*/5HCl.
0·108	0·0035	0·183	0·0398

N. H. J. M.

Influence of various Plants on the Amount of Moisture in the Soil. By MAX MAERCKER (*Bied. Centr.*, 1899, **28**, 436—437; from *Landw. Jahrb.*, 1898, **27**, 170).—The amount of moisture in soil growing various crops was determined twice a week. At the commencement (May 21), the amounts of moisture were fairly uniform, except in the case of the oat plot, which was rather dryer than the others. During the first few weeks there was comparatively little change in the case of sugar-beet, potatoes, and peas, whilst the oats, and especially the wheat, took up large amounts of water. In July, the sugar beet began to take up more water, and the soil became almost as dry as that under wheat.

After the peas and the wheat were cut, it was found that the former left considerably more moisture in the soil than the latter, whilst sugar beet takes up as much moisture as any crop when the leaves are fully developed. N. H. J. M.

Changes in Butter Produced by Feeding with Fat. By GEORG BAUMERT and FR. FALKE (*Bied. Centr.*, 1899, **28**, 452—454; from *Zeits. Unters. Nahrungs u. Genussmittel*, 1898, Heft. 10, 665).—Two cows were fed during successive periods with different oils, in the form of emulsions, in addition to hay and rape-cake meal freed from fat. During the first and last periods, the oil was omitted. The results of analysis of the butter produced under the different conditions showed, not only that the oil in the food essentially altered the nature of the butter, but that the changes varied in accordance with the character of the oil. The determinations made were the Köttstorf, Reichert-Meissl, and the von Hübl iodine numbers.

The results are thus opposed to those of Soxhlet, which indicated that the fat in food does not pass into the milk, but that it replaces the fat already existing in the body, enabling a portion of the body-fat to migrate to the milk (compare Abstr., 1898, ii, 402). N. H. J. M.

Assimilability of Organic Nitrogen in Sterilised Media. By A. LYEBYEDYEV (*Expt. Stat. Record*, 1899, **10**, 723; from *Selsk. Khoz. Lyesov.*, **186**, 1897, No. 7, 159—169).—Barley was grown in sand manured with urea, hippuric acid, leucine, aspartic acid, and asparagine respectively, calcium carbonate being added to obtain neutrality. The sterilised cultivations produced very little growth, and seed was only produced in the pots manured with asparagine. In the case of similar pots inoculated with soil extract, the following amounts of dry produce (roots, straw, and grain) were obtained: hippuric acid; 1·05; urea, 0·778; leucine, 4·246; asparagine, 2·942; aspartic acid, 0·920 gram.

Calcium nitrate produced far more growth (over 10 grams) than any of the organic substances. N. H. J. M.

Sugar as an Agent in Nitrogen Fixation and an Aid to the Growth of Plants. By JOHN GOLDING (*J. Soc. Chem. Ind.*, 1899, **18**, 564—566).—Lucerne, beans, clover, and sainfoin were grown in pure sand, with mineral manure, both with and without addition of cane sugar (5 and 10 grams). The pots, previously sterilised, were inoculated with water containing a portion of a crushed nodule taken from a corresponding plant. The following amounts of green produce were obtained (grams).

	Lucerne.			Beans.
	Stems, &c.	Roots.	Total.	Entire plants.
Without sugar	25·0	16·3	41·3	53·5
With sugar	38·1	21·6	59·7	62·1

The distinct gain in produce under the influence of cane sugar is attributed to increased energy of the nitrogen-fixing bacteria.

N. H. J. M.

Composition of Starfish. By GEORGE WILTON FIELD (*Ann. Rep. Agric. Expt. Stat. Rhode Island,* **10**, 1898, ii, 150—165).—Analyses of starfish (*Asterias Fobesii*) obtained in Narragansett Bay, were made in order to ascertain its value as manure. The percentage results in (1) the live unrinsed starfish and (2) the dry matter of the rinsed starfish were:

	N.	Crude ash.	K_2O.	CaO.	P_2O_5.
(1)	1·80	20·34	0·23	9·62	0·20
(2)	5·20	58·84	0·66	27·82	0·57

N. H. J. M.

Action of Bremen Poudrette on Sandy Soil. By BRUNO TACKE (*Bied. Centr.*, 1899, **28**, 437—438; from *Mitt. Ver. Förd. Moorkultur*, 1897, **15**, No. 22, 369).—In order to ascertain the relative value of the nitrogen of poudrette as compared with that of sodium nitrate, winter rye and potatoes were grown in a cultivated, sandy soil, and manured with 21·07 kilograms of nitrogen per hectare in the two forms. Kainite and basic slag were also applied, and the soil, which contained a good deal of humus, had been previously marled. In a second experiment, 42·15 kilograms of nitrogen were employed

Taking the yield of produce obtained under the influence of nitrogen as 100, the yield of rye manured with poudrette was 58 with the smaller, and 56 with the larger quantity of manure. In the case of potatoes, the action of the smaller amount of nitrogen in the form of poudrette was 65, as compared with 100 for the nitrate. The results of the two experiments taken together show that the nitrogen of the poudrette was equivalent to about 60 per cent. of nitrogen in the form of nitrate, a somewhat higher result than that obtained by Maercker (*Mitt. deut. Landw. Ges.*, 1897, Stck. **17**, 218). N. H. J. M.

How much Basic Slag should be Applied to Meadows? By PAUL WAGNER (*Bied. Centr.*, 1899, **28**, 439—442; from *Deut. landw. Presse*, 1898, **25**, Nos. 1 and 2).—The opinion that 4 cwt. of basic slag per hectare is a sufficient application for the greatest amount of produce is based on an error in Wolff's tables, according to which hay contains 0·43 per cent. of phosphoric acid. Hay from good meadows may contain a considerably higher percentage of phosphoric acid.

According to the amount of phosphoric acid present in the soil, a meadow should receive the first year 12, 16, or 20 cwt. of basic slag, the amount being made up to 24 cwt. the second year. In subsequent years, 5 cwt. of basic slag (containing 16 per cent. of phosphoric acid) may be applied for every cwt. of hay obtained.

In the case of rich soil, containing, for example, 0·15 per cent. of phosphoric acid, a yearly application of 4 cwt. of basic slag would be sufficient for the best crops. N. H. J. M.

Manurial Experiments with Sugar Beet. By MAX MAERCKER (*Bied. Centr.*, 1899, **28**, 442—443; from *Landw. Jahrb.*, 1898, **27**, 32).—The object of the experiments was to ascertain whether a top-dressing of sodium nitrate has an injurious effect on the amount of sugar produced, and whether different varieties of roots are differently affected by the top-dressing.

The different varieties varied less in amount of roots than in leaf production. Generally, but not invariably, there was a relation between the amounts of leaf and of sugar; varieties which produced least leaf contained 2·72 per cent. less sugar than the varieties with the greatest amounts of leaf.

Omission of nitrogenous manure influenced the yield considerably; but the top-dressing of sodium nitrate had, in these experiments, no effect on the sugar production. Probably the particularly favourable season (1896) prevented any injurious action. N. H. J. M.

Manurial and Variety Experiments with Barley. By MAX MAERCKER (*Bied. Centr.*, 1899, **28**, 443—446; from *Landw. Jahrb.*, 1898, **27**, 94).—Although the soil of the field in which the experiments were made contained 0·25 per cent. of potash, the application of kainite increased the yield of grain 192·3 kilograms per hectare; the quality of the grain was also improved, the grain containing 64·3 per cent. of starch instead of 60·0 per cent.

Excess of nitrogenous manure is injurious, especially when there is a deficiency of mineral matter. Guano gave slightly less grain and straw than sodium nitrate, but the grain was of the best quality. In conjunction with guano, potash was without effect.

As regards the composition of barley, the results given for nitrogen in Wolff's tables are too high both for grain and for straw, and the results for potash in grain are somewhat low. Barley-straw was found to contain 1·65 per cent. of soda (Wolff gives 0·16 per cent.), probably owing to the prolonged use of manures rich in soda. N. H. J. M.

Determination of the Manure Requirements of Soils. By GEORG LIEBSCHER and EDLER (*Bied. Centr.*, 1899, **28**, 448—452; from *J. Landw.*, 1896, 84).—Pot experiments were made with oats, and both the produce and the soil analysed. The soil contained 0·6—0·7 per cent. of nitrogen, and the application of nitrogenous manure always increased the yield of produce, whilst without nitrogenous manure the produce was poor in nitrogen. Exclusive potash manuring diminished the percentage of nitrogen in the produce, and complete mineral manure had a still greater effect. Without nitrogenous manure, that is, with small amounts of produce, the percentage of phosphoric acid in the produce was comparatively high. Potash manuring increased in every case the amount of potash in the produce, whilst with a complete manure the percentage of potash was lowest. It is concluded that, under equal conditions of cultivation, including temperature and moisture, the analysis of the crops will give trustworthy evidence as to the wants of the soil, inasmuch as results are obtained in accordance with the results of manuring experiments. Von Seelhorst, however, thinks that this method would not have the same value in practice, since plants grown in the field often differ a good deal in composition from those obtained in pot cultures. N. H. J. M.

Employment of Ammoniacal Manures on Calcareous Soils. By Ercole Giustiniani (*Ann. Agron.*, 1899, **25**, 325—335).—Experiments were made to ascertain the effect of different amounts of chalk on ammonium salts in sterilised sand, and the influence of temperature and moisture on the loss of nitrogen as ammonia. Purified air was passed through the sand (200 grams) to which dilute ammonium sulphate had been added, and afterwards through titrated sulphuric acid in which the ammonia was subsequently determined. In the first experiment, there were four flasks with sand, (1) without and (2, 3, and 4) with 0·36, 10, and 40 per cent. of chalk respectively, a fifth flask containing chalk alone. The amounts of water and of nitrogen as ammonia were 5·0 and 0·054 per cent., and the temperature was 12—24°. In absence of chalk, there was no loss of ammonia, whilst with the smallest amount of chalk, there was a loss of 22·8 per cent. in 22 days, and the loss increased slightly with increased amounts of chalk. With chalk alone, the loss was greatest (26·7 per cent.). The same flasks were next subjected to a higher temperature (30—42°) for 18 days. The total loss (40 days) was almost the same in each case (94·3—95·7 per cent.).

A similar experiment, in which dry air was employed, showed that although 60 per cent. of the moisture in the sand was lost in 10 days, nearly all the ammonia was lost in presence of chalk, the proportion of chalk having no appreciable effect on the result.

On substituting basic slag (0·1, 1, and 3 per cent.) for chalk, it was found that the largest amount caused the loss of most of the ammonia in 24 hours. N. H. J. M.

Analytical Chemistry.

Correct Values of Empirically Divided Hydrometer Scales. By Paul Fuchs (*Zeit. anal. Chem.*, 1899, **38**, 333—341).—The author gives tables showing the true density (at a stated temperature in each case) corresponding with each degree of a number of hydrometers in use for technical purposes. These include the rational Baumé scale, the Beck and Cartier instruments, Fischer's and two other oil-hydrometers, the percentage salinometer, and a special instrument for the percentage of acetic acid in vinegar. As has frequently been pointed out, the instruments in actual use often deviate seriously both from the intended values and from one another. M. J. S.

Volumetric Estimation of Sulphur in Cast Iron, Steel, &c., by Arsenious Acid. By J. Thill (*Zeit. anal. Chem.*, 1899, **38**, 342—344).—The metal is dissolved in hydrochloric acid and the evolved gases passed through a mixture of 25 c.c. of *N*/10 arsenious acid and 50 c.c. of cold saturated sodium hydrogen carbonate solutions. The absorption apparatus of E. Franke, or that of Wiggert and von Reis, is recommended, because it is necessary to cool the vapours from the evolution flask. The acid must be added to the metal very slowly, and then kept just at the boiling point until all the metal is dissolved; the gases are then driven over into the absorption vessel by carbonic anhydride. The arsenite is then acidified, made up to 500 c.c., filtered, and 100 c.c. titrated with *N*/50 iodine solution after making alkaline with ammonium carbonate. Very good results are obtained.

M. J. S.

Estimation of Sulphur in Substances Rich in Iron. By C. Meineke (*Zeit. anal. Chem.*, 1899, **38**, 351—352).—The author has compared Lunge's process for the analysis of pyrites with that recommended by himself and by Heidenreich (this vol., ii, 517, 518), and obtained absolutely identical results. M. J. S.

Electrolytic Method for Estimating Nitrogen in Organic Substances. By C. C. L. G. Budde and C. V. Schou (*Zeit. anal. Chem.*, 1899, **38**, 344—348).—The substance is mixed with 4 c.c. of fuming and 8 c.c. of ordinary sulphuric acid, as in the Kjeldahl process, and the liquid is electrolysed. Rapid oxidation ensues, and the nitrogen is converted into ammonia. The apparatus used is a globular flask of 50 c.c. capacity, with a pocket holding 10 c.c. projecting downwards from the bottom. The electrodes, consisting of a cylindrical anode of platinum foil, with a stout platinum wire in its axis for the cathode, are passed to the bottom of the pocket, and the connecting wires, which are protected by glass tubes, are connected with an electric supply of 8 volts. Only a feeble current passes at first, but the current soon rises to about 10 ampères, and the liquid becomes hot. Sulphurous anhydride is given off, and sulphur is often deposited in the neck of the flask. In about 3/4 hour the liquid will, as a rule, have become colourless, although a small, black deposit often forms, and the cathode is covered with a black powder. About half of the sulphuric acid will have disappeared. Excess of soda is added and the ammonia distilled as usual. A great advantage of the process is that no reagent other than sulphuric acid is required, as this greatly facilitates the examination for inorganic constituents. The electrolysed solution may be diluted and treated with hydrogen sulphide before distilling off the ammonia. Most of the substances tried gave results agreeing more closely with theory than those obtained with the ordinary Kjeldahl process, but uric acid and ethylic cyanurate gave low numbers, and the method is altogether inapplicable to cyclic compounds containing more than one atom of nitrogen in the ring.

M. J. S.

Analysis of Nitrites. By E. Orloff (*Chem. Centr.*, 1899, i, 805; from *Techničeski Sbornik*, 1899, i, 29).—0·1 gram of the nitrite dissolved in 10 c.c. of a 10 per cent. solution of potassium iodide is carefully introduced into a Lunge's nitrometer. 25 c.c. of a solution of 1 gram of arsenious acid and 5 grams of sodium carbonate in 200 c.c. of water are then added; this must, however, be first neutralised by hydrochloric acid and freed from carbonic anhydride by boiling. Finally, 2—3 c.c. of strong hydrochloric acid are added. The brown liquid soon becomes colourless as the iodine is absorbed by the arsenious acid, and consequently the mercury remains clear. The volume of the nitric oxide is now read off and reduced to weight.

L. de K.

Estimation of Carbon and Hydrogen in Organic Substances containing Nitrogen. By Olin F. Tower (*J. Amer. Chem. Soc.*, 1899, **21**, 596—605).—The substance is burnt in a current of purified oxygen, the water being absorbed by calcium chloride, and the carbonic anhydride collected in two soda-lime tubes, a small U-tube containing glass wool moistened with sulphuric acid being placed between the two. When the combustion is finished, the oxygen is swept out by a current of purified air.

When dealing with nitrogenous matter, such as amido- or nitro-compounds, it has not been found necessary to use a spiral of metallic copper, except in the case of picric acid, which appears to yield some nitric peroxide. The soda-lime and the sulphuric acid were afterwards repeatedly tested for nitric compounds, but none were found; moreover, the carbon determinations were quite satisfactory.

L. de K.

Carbon Combustions in a Platinum Crucible. By Porter W. Shimer (*J. Amer. Chem. Soc.*, 1899, **21**, 557—558).—The amount of carbon in steel is estimated as follows:—The sample is treated with an acidified solution of copper potassium chloride, and the carbon collected on asbestos, or a little asbestos is added to the liquid, and then collected on a Gooch crucible. When washed and dried, the asbestos is put, carbon side downwards, into a platinum crucible, taking care that all the carbon is kept within a quarter of an inch of the bottom; if a Gooch crucible has been used, it is placed inside the platinum crucible without its cap. The crucible is then nearly filled with asbestos. The essential part of the apparatus is a water-cooled stopper for closing the crucible; it is made of sheet copper and fitted with a band made of pure black rubber. There is no danger of burning or softening the rubber, for it is cooled by the water passing through the stopper, and also by a wet wick wrapped a few times round the upper part of the crucible, the ends of the wick drawing water from a circular trough kept full by the overflow from the stopper.

The carbon is burnt in a current of purified air, the inlet and outlet tubes for which pass through the stopper, and a blast lamp is used as the source of heat. The products of combustion pass through a small tube containing copper oxide and heated by a single Bunsen burner, and then through a tube filled with glass beads moistened with water, to retain chlorine compounds; no advantage was found to arise from the use of silver sulphate. The gas is then dried over calcium chloride, and the carbonic anhydride is absorbed in a weighed Geissler potash apparatus.

The apparatus may also be used for other purposes, such as the estimation of carbonic anhydride and water in limestone by ignition.

L. de K.

Analysis of Silicon. By Hugo Bornträger (*Zeit. anal. Chem.*, 1899, **38**, 350—351).—About 10 grams of potash are dissolved in 100 c.c. of water in a large silver basin, and 0·5 gram of the finely-divided silicon is added while gently warming. The substance readily dissolves, leaving the alumina, ferric oxide, and ferro-silicon which are present as impurities. These are collected on a filter and washed until free from alkali. They are then dissolved in hydrochloric acid and the solution evaporated. After filtration from traces of silica, the ferric oxide and alumina are precipitated by ammonia and weighed together. The iron is then estimated by reduction and titration. Silicon is found by difference.

M. J. S.

Estimation of Potassium as Platinochloride. By Friedrich Bolm (*Zeit. anal. Chem.*, 1899, **38**, 348—350).—The platinochloride is collected on an unweighed filter (which has been previously washed with hot water and alcohol, and not dried), and is washed with 96 per cent. alcohol. After expelling the adhering alcohol in the oven, the precipitate is dissolved in boiling water and the solution evaporated in a glass or porcelain (not platinum) basin. The salt deposits in concentric rings on the wall of the basin, and can be dried to a constant weight in half an hour at 130°. It may then be reduced by Sonstadt's method (Trans., 1895, **67**, 984) by dissolving it in the basin in a little hot water, adding mercury, and stirring while keeping hot, until the solution is colourless.

M. J. S.

Estimation of Potassium and Sodium [in Rocks]. By Edmond Bonjean (*Bull. Soc. Chim.*, 1899, [iii], **21**, 691—693).—The process recommended differs from those commonly employed, chiefly in the fact that both sodium and potassium are estimated directly. The solution, from which silica, oxide of iron, alumina, and lime have been removed in the usual way, is evaporated to dryness, and the residue, after expulsion of ammonium salts by ignition, dissolved in water, and the magnesium precipitated as ammonium magnesium phosphate. The phosphoric acid in the filtrate is precipitated by 10 per cent. normal lead acetate solution, and the excess of the latter removed by means of hydrogen sulphide. The potassium is finally converted into potassium platinochloride, from which, after collection, the platinum is precipitated by metallic magnesium, whilst the sodium in the filtrate is weighed as sulphate, after removing excess of platinum by treatment with hydrogen sulphide.

N. L.

Volumetric Estimation of Zinc. By Pouget (*Compt. rend.*, 1899, **129**, 45—47).—The process described is based on Rollet and Campredon's method for the estimation of sulphur. The acid solution, mixed with sodium acetate, is treated with ammonia until a permanent precipitate is produced, and then excess of hydrogen sulphide solution is added. The liquid is boiled until hydrogen sulphide is completely expelled, then mixed with a known volume of standard iodine solution, left for a short time, and the excess of iodine titrated with sodium thiosulphate solution, using starch as indicator. In this process, the troublesome filtration and washing of the precipitated zinc sulphide are avoided; the results are accurate. N. L.

Kjeldahl's Process for Destroying Organic Matter Applied to the Detection of Metals in Foods, &c. By A. HALENKE (*Chem. Centr.*, 1899, **1**, 551; from *Zeit. Unters. Nahr.-Genussm.*, **2**, 128—132).—The following process is recommended for the detection of zinc and other volatile metals, with the exception of mercury, in articles of food: 50 grams of the substance, dried apples, for instance, are boiled with 175 c.c. of sulphuric acid and 1 gram of mercuric oxide for 8 hours in a 750 c.c. Kjeldahl flask; the residue occupying about 10 c.c. is dissolved in 250 c.c. of water, the mercury removed by hydrogen sulphide, and any zinc estimated in the filtrate. For the detection of zinc in flour, 25 grams of the sample are first charred by means of 30 c.c. of sulphuric acid; 3 successive portions of 10 c.c. of acid are then added at intervals of 10 minutes, and after heating for another half-hour, 65 c.c. more acid and 1 gram of mercuric oxide are added and the mixture boiled for five hours. If not sufficiently concentrated, the liquid is transferred to a platinum dish and boiled down to 20 c.c. The residue is then dissolved in water and treated as directed. The test analysis is satisfactory. L. DE K.

Titration of Iron in Hydrochloric Acid Solution. By WILLENZ (*Chem. Centr.*, 1899, **1**, 638—639; from *Ann. chim. anal. appl.*, **4**, 37—41).—The author recommends a process originated by Reinhard, but now almost forgotten (compare, however, Abstr., 1898, ii, 646). 60 grams of tin are dissolved in 250 c.c. of hydrochloric acid of sp. gr. 1·19 and then diluted to 500 c.c.; after filtering, 500 c.c. of acid of sp. gr. 1·12 are added and then 1 litre of water. A solution is also prepared containing 200 grams of crystallised manganous sulphate in a litre of water and mixed with 200 c.c. of sulphuric acid. To the boiling solution of the ferric salt the solution of the tin is gradually added until the yellow colour has completely vanished; large excess should be avoided. The source of heat is now removed and 60 c.c. of the manganese solution, 600 c.c. of cold water and 50 c.c. of a cold-saturated solution of mercuric chloride are added and the iron at once titrated with permanganate.

L. DE K.

Influence of Ammonium Salts on the Precipitation of Nickel by Ammonia. By ARTHUR MARSHALL (*Analyst*, 1899, **24**, 202—205).—Unless a large excess of ammonium salts or free ammonia are present, dilute ammoniacal solutions of nickel are apt to deposit a large quantity of the metal as a basic salt, particularly on warming; the presence of sufficient tartaric acid, however, prevents the precipitation.

In one experiment, about 60 per cent. of the nickel present was precipitated as a light green deposit having the composition

$$NiSO_4,8NiO,16H_2O.$$

Cobalt and zinc behave in a similar manner. L. DE K.

Separations of Metallic Sulphides by Means of Hydrogen Chloride. By J. Bird Moyer (*J. Amer. Chem. Soc.*, 1899, **21**, 642—645).—The sulphides of arsenic, antimony, or bismuth may be separated from lead sulphide by passing hydrogen chloride over the heated mixture; sulphide of arsenic may also be separated from sulphides of cadmium or silver in a similar manner. The non-volatile sulphides are converted more or less completely into chlorides during the process. J. J. S.

Analysis of Water. By George H. Bailey and J. H. Johnston (*J. Soc. Chem. Ind.*, 1899, **18**, 455—457).—*Use of phenolphthalein as an indicator.*—When determining the acidity in water by titrating with standard alkali, using phenolphthalein as indicator, the results may be vitiated by the presence of ammonium salts. If to a solution of ammonium chloride phenolphthalein and solution of sodium hydroxide are added, a considerable quantity of the latter may be added before the liquid turns red; on diluting, it is decolorised and then consumes another portion of alkali; the process is also considerably influenced by the temperature.

Collection and examination of samples of water.—The authors show the necessity of having the bottles completely filled and carefully stoppered; even then the analysis ought not to be delayed. Examples are given where the free ammonia, originally large, had completely disappeared in a fortnight, and the albuminoid ammonia had also much diminished. This is due to oxidation by the oxygen dissolved in the water, as proved by the proportional increase in the nitrites and nitrates.

Acidity of boiler waters and steam.—Acid waters act seriously on the boiler, but not until the acidity (calculated as hydrogen chloride) reaches nearly 1 per cent. will there be any danger of acid escaping with the steam and injuring the steam valves. Acid may be liberated in the boiling water by decomposition of certain neutral salts, such as magnesium chloride. L. de K.

Use of Hyposulphite for Titration, especially for the Estimation of Oxygen in Water and Sewage Effluents. By B. William Gerland (*J. Soc. Chem. Ind.*, 1899, **18**, 340—342).—The author gives further instructions as to the estimation of dissolved oxygen in waters, the method employed being substantially the same as the one described in a former paper (*J. Soc. Chem. Ind.*, 1896, **15**, 16). Ordinary coal gas is still employed to displace the air in the apparatus after being freed from oxygen by passing it through an iron pipe filled with copper filings and heated to redness. As regards the indigo used in the process, it is of importance to use a preparation which, when treated with solution of hyposulphite (hydrosulphite), shall change to a yellow, and not to a brown, colour; such indigo may be prepared as follows: indigo is treated with hydrochloric acid, washed, digested with weak caustic soda or ammonia, washed, dried, and crystallised from boiling nitrobenzene. The crystals are washed with benzene, dried, warmed with hydrochloric acid, roughly washed and digested for some hours with hydrogen peroxide or ammonium persulphate in acid solution. After filtering, the product is first washed with water, then with weak ammonia, and when dry exhausted with strong alcohol. After drying at 110°, it may be regarded as pure indigotin, which is then dissolved with the usual precautions in strong sulphuric acid. L. DE K.

Distinctions between Mercuric Cyanide and Oxycyanide. By VON PIEVERLING (*Chem. Centr.*, 1899, i, 504; from *Pharm. Centr. Halle*, **39**, 615—616).—Mercuric cyanide forms well-defined crystals, is more readily soluble in water than the oxycyanide, and is neutral to test-paper, whilst the oxycyanide forms a yellowish, crystalline powder having an alkaline reaction. The oxycyanide is precipitated by ammonia or tannin, and also by disodium hydrogen phosphate or potassium chromate in the presence of ammonia; these precipitates are rapidly reduced by stannous chloride. If a solution of mercuric cyanide (1 : 20) is mixed with a solution of potassium iodide (1 : 3), crystals of silvery lustre are gradually formed, which dissolve in ammonia and more water to a colourless liquid. A solution of the oxycyanide (1 : 20), when similarly treated, turns yellow and becomes turbid and orange-red on adding ammonia. On standing, a reddish-brown precipitate is formed, which is soluble in potassium iodide; this solution also deposits silvery crystals. L. DE K.

Distinction between Mercuric Cyanide and Oxycyanide. By WILLY WOBBE (*Chem. Centr.*, 1899, i, 504—505; from *Pharm. Centr. Halle*, **39**, 934—935).—The author criticises von Pieverling's paper (preceding abstract) and states that the tests fail with dilute (1 per cent.) solutions. The following tests are proposed: the oxycyanide forms a micro-crystalline, faint yellowish, and faintly alkaline powder. Its 5 per cent. solution is precipitated by tannin and reduced by stannous chloride, whilst ammonia yields a precipitate soluble in excess. Disodium hydrogen phosphate or potassium chromate gives a precipitate soluble in ammonia. A 5 per cent. solution of potassium iodide, added drop by drop, gives a yellow coloration, turning red on adding ammonia; after a while, a reddish-brown precipitate forms, which is soluble in potassium iodide. Hydrogen sulphide or ammonium sulphide precipitates mercuric sulphide. L. DE K.

Mercuric Oxycyanide. By VON PIEVERLING (*Chem. Centr.*, 1899, i, 505; from *Pharm. Centr. Halle*, **40**, 22—23).—The author, in reply to Wobbe (preceding abstract), states that the commercial oxycyanides vary much in composition and rarely agree with the formula $HgO,HgCy_2$; this explains the varying surgical value of these preparations. The author agrees that, to make his tests work well, strong solutions should be employed.

A proper article should conform to the following test: 3 c.c. of its 5 per cent. solution should give a deep yellow colour on adding 3 drops of a 50 per cent. solution of potassium iodide. L. DE K.

Estimation of Alcohol and Ether in the Presence of Light Petroleum. By HENRY DROOP RICHMOND (*Analyst*, 1899, **24**, 201—202).—*Estimation of alcohol.*—20 c.c. of the mixture are shaken with 25 c.c. of water, saturated with ether, and the volume of the ethereal layer (A) is noted. The aqueous layer is drawn off and the liquid is again shaken with 25 c.c. of etherised water; the volume (B) of the ethereal layer is then again noted. Then 2A – B gives the volume of ether and light petroleum and $(20 + B - 2A) \times 5$ equals the percentage by volume of alcohol in the original mixture.

Estimation of light petroleum.—A mixture is prepared of 20 c.c. of 90 per cent. sulphuric acid and 20 c.c. of glacial acetic acid. When cold, 10 c.c. of the sample is introduced into a burette and the acid is gradually added, the mixture being well shaken after each addition. The ether and alcohol are completely dissolved and the volume of light petroleum is then read off. Two satisfactory test-analyses are given. L. DE K.

Chemistry and Analysis of Wine. By MAXIMILIAN RIPPER (*Chem. Centr.*, 1899, i, 548—549; from *Zeit. Landw. Vers.-Wes. Öst.*, 2, 12—23).—The author calls attention to the importance of the ethereal salts in wine. Claret, for instance, is medicinally preferable to white wines, notwithstanding that it contains more tannin, on account of its larger percentage of volatile ethereal salts. The author divides the ethereal salts into two classes, volatile and non-volatile. Those which are volatile are divided into compounds which distil unaltered and others which suffer decomposition; a quantitative separation of these two groups is as yet impossible. The chief constituent of the first group is ethylic acetate, whilst small quantities of ethylic butyrate and ethylic succinate are also present; in practice, these may be expressed as acetate. The author contradicts the statement that the volatile ethereal salts of wine are only saponified by hot alkalis, as it was found that, with a reasonable excess of potassium hydroxide dissolved in proof-spirit, saponification was complete within an hour. Allowance must, of course, be made for the volatile acid accompanying the ethers when estimating their amount by the saponification process.

The detection and separation of the non-volatile ethereal salts in wine is beset with difficulties, and the author has only isolated ethylic tartrate and glycerylic tartrate. L. DE K.

Analysis of Wines. By MAX BARTH (*Chem. Centr.*, 1899, i, 550; from *Zeit. Unters. Nahr.-Genussm.*, 2, 106—118).—The product obtained by fermenting pressed out grapes often mixed with stalks consists of an inferior wine with a large extract in which tannin predominates. To identify such a wine or to detect its presence in other wines, a new colorimetic method for the estimation of tannin has been devised.

A standard solution is prepared containing in 100 c.c. 0·2 gram of acetic acid, 6 grams of alcohol and 0·05 gram of pure tannin. Of this, 10 c.c. is mixed in a Desaga's tannin tube with 1 c.c. of a 20 per cent. solution of sodium acetate and 5 drops of a 10 per cent. solution of ferric chloride. A black liquid is obtained, quite opaque on the top and only just transparent when viewed through the elongated bottom part of the tube. More dilute solutions for comparison cannot be prepared from this, as oak bark tannin gives on dilution quite different tones to œnotannin; the solution actually used for comparison is therefore prepared as follows: An alcoholic extract is made of fresh, undried grape stones, which is then diluted with water containing 0·2 per cent. of acetic acid until the coloration obtained on adding ferric chloride is the same as that given by the standard solution. This solution can be diluted to any desired extent for purposes of comparison.

The sample to be tested must be quite clear and its acidity is rendered exactly 0·2 per cent. by volume, either by partially neutralising or else by carefully adding acetic acid. If it should contain more tannin than the standard solution, it must be suitably diluted with water containing 0·2 per cent. of acetic acid. The ferric chloride should be put into the two tubes at as nearly as possible the same moment. L. DE K.

A New Principle for the Testing of Sugared ("Gallisierter") Wines. By MÖSLINGER (*Chem. Centr.*, 1899, 1, 549—550; from *Zeit. Unters. Nahr.-Genussm.*, 2, 93—106).—The author states that sugared wines invariably show a less amount of residual acidity than true wines. This residual acidity is found by subtracting from the total acidity the acidity due to the volatile acids calculated as tartaric acid, and also the free and half-combined tartaric acid; the figure obtained is not less than 0·28 per cent. in genuine wines.

As it is possible to defeat this test by adding citric acid, the author has devised a simple method for the detection of that acid. 50 c.c. of the sample are evaporated to a thin syrup and then mixed slowly with 70—80 c.c. of 95 per cent. alcohol. (Free tartaric acid must first be removed by adding a calculated quantity of potassium hydroxide and so converting it into potassium hydrogen tartrate.) The filtrate is freed from alcohol by evaporating to 10 c.c.; 5 c.c. of this is then mixed with 0·5 c.c. of acetic acid and a strong solution of lead acetate is added; if citric acid is present, a precipitate is obtained which disappears on heating. The hot liquid, if turbid, is filtered, and any citrate precipitate will then reappear on cooling. L. DE K.

New Method for the Analysis of Commercial Phenols. By SAMUEL B. SCHRYVER (*J. Soc. Chem. Ind.*, 1899, **18**, 553—556).—The process is based on the fact that phenol and its homologues (1 mol.), when acting on sodamide, liberate ammonia (1 mol.). About ½ gram of finely-powdered sodamide is washed a few times by decantation with small quantities of benzene, and then introduced into a 200 c.c. distilling flask fitted with a separating funnel and with an inverted condenser in connection with an apparatus for absorbing ammonia, and this in turn with an aspirator. About 60 c.c. of benzene are introduced into the flask, and this is boiled on the water-bath for 10 minutes, a slow current of dry air, free from carbonic anhydride, being drawn through in order to free the apparatus and contents from ammonia. 20 c.c. of *N* sulphuric acid are then placed in the absorption apparatus, and the solution of the phenol in pure benzene (freed from any moisture by prolonged contact with fused sodium acetate) then introduced into the distilling flask and the boiling continued; the ammonia evolved is absorbed by the standard sulphuric acid, the excess of which is then titrated with sodium carbonate, using methyl-orange as indicator.

The method may be successfully employed for the estimation of phenols in essential oils, such as guaiacol in wood tar, thymol in oil of thyme, and eugenol in oil of cloves. If the total weight of two phenols is known, their respective amounts may be approximately calculated from the amount of ammonia evolved.

Water in phenols may be estimated by making two experiments, one before, and one after drying; the difference in ammonia represents moisture. L. DE K.

Volumetric Estimation of Glucose. By LÉON GARNIER (*J. Pharm.*, 1899, [vi], **9**, 326—330. Compare this vol., ii, 529).—This process is a modification of the Haen-Lehmann method, and is carried out as follows:—50 c.c. of Fehling's solution (10 c.c. = 0·05 gram glucose) are placed in a porcelain dish, diluted with an equal volume of water, and heated to boiling, and to this is added a volume of the glucose solution insufficient for the complete reduction of the Fehling's solution. The liquid is boiled for 2 minutes and poured into a 250 c.c. flask, which is filled to the graduation mark with boiling distilled water. The whole is rapidly cooled, accurately diluted to 250 c.c., and thoroughly mixed, the flask then corked and left for 2—6 hours until the liquid is quite clear.

The excess of Fehling's solution is determined thus:—To 25 c.c. of the clear solution contained in a stoppered flask are added 1 c.c. of dilute sulphuric acid (1 : 3) and 10 c.c. of iodine solution, prepared by dissolving 1 gram of iodine and 1·5 grams of potassium iodide in 200 c.c. of water. The flask is corked and left for ten minutes, a little starch paste is added, and then thiosulphate solution (1 c.c. = 1 c.c. iodine solution) in slight excess; the blue colour is brought back by the careful addition of iodine solution. The strength of the iodine solution is determined by titrating 5 c.c. of the Fehling's solution in the manner just described. From the data so obtained, the volume of Fehling's solution reduced by the glucose is readily calculated. H. R. LE S.

Estimation of Methylated Pentoses. By EMIL VOTOČEK (*Chem. Centr.*, 1899, i, 642; from *Zeit. Zuck.-Ind. Bohm.*, **23**, 229—241. Compare Abstr., 1897, i, 405).—The compound, such as rhamnose, is distilled with hydrochloric acid of 12 per cent. strength, the liquid in the distilling flask being constantly replenished with acid, until 400 c.c. have been collected in the receiver; strong hydrochloric acid is then added to make up to 500 c.c., the liquid being now supposed to contain 12 per cent. of hydrogen chloride. Two hundred c.c. of the liquid are mixed with about three times as much pure, powdered phloroglucinol as is actually required, and after some time the precipitate, consisting of methylfurfuraldehyde-phloroglucide, is collected, washed until the red colour has changed to yellow, dried at 110° in a current of hydrogen, and weighed. The compound may contain an admixture of furfuraldehyde-phloroglucide, but the joint amount of methylfurfuraldehyde and furfuraldehyde may be calculated with reasonable accuracy by multiplying the weight obtained by 1·024. To estimate methylfurfuraldehyde and furfuraldehyde in the presence of each other, Schiff's reaction may be utilised. One hundred c.c. of the distillate are neutralised with soda, acetic acid is added until its amount reaches 5 per cent., and an alcoholic solution of xylidine is added, which gives a red coloration with the furfuraldehyde. After remaining for half an hour in the dark, the liquid is tested in a Krüss colorimeter, using as the liquid for comparison a 0·01 per cent. solution of furfuraldehyde in 5 per cent. acetic acid mixed with xylidine solution. If much methylfurfuraldehyde is present, the yellow colour of the methylfurfurylidenexylidine interferes with the red colour, so that in such a case the test should be made in gas-light. The process is not trustworthy if only relatively small quantities of methylfurfuraldehyde are present, as it is then no longer admissible to estimate this by difference; a direct colorimetric test for this substance has yet to be found.

The presence of methylfurfuraldehyde in the acid distillate of the seeds of beet shows these to contain methylpentoses. L. DE K.

Influence of Temperature on the Specific Rotation of Sucrose, and a Method of Correcting Readings of Compensating Polariscopes therefor. By HARVEY W. WILEY (*J. Amer. Chem. Soc.*, 1899, 21, 568—596).—The author has made a lengthy investigation as to the influence of temperature on the specific rotatory power of sucrose and has tabulated the results.

It is now proved beyond doubt that the rotatory power of sucrose at 17·5° is 66·547, whilst at 4° it is 66·657, and at 40°, 66·299. It therefore increases when the temperature falls and decreases as the temperature rises, but the mean rate of increase is not the same at every temperature, as it appears to be greater from 15° to 17·5°, from 20° to 25°, and from 30° to 35° than at other points at which the observations were made. L. DE K.

Estimation of Pentosans and its Application to Food Analysis. By OTTO HEHNER and WILLIAM P. SKERTCHLY (*Analyst*, 1899, 24, 178—183).—An important factor in the analysis of such articles as cocoa, pepper, mustard, coffee, &c., is the amount of husk. This may be determined by the well-known acid-alkali method, but the authors have found that much better results are obtained by estimating the amount of pentosans and calculating the husk from these constituents.

Black pepper, for instance, gave about twice as much crude fibre as white pepper, but it yielded three times the amount of pentosans. Pressed cocoa contains 6—7 per cent. of crude fibre, and cocoa-shell powder about 12 per cent., but whilst the former contains only 2 per cent. of pentosans, the shells contain 8—9 per cent. Pure mustard flour contains but little pentosan, whilst mustard husk contains a large quantity. There is also a decided difference in the amount of pentosan yielded by coffee and chicory.

The results are fully explained and tabulated. The analytical process used is the one recommended by Tollens and Krüger (Abstr., 1897, ii, 353) coupled with Councler's method for the estimation of furfuraldehyde (Abstr., 1895, ii, 144). L. DE K.

Estimation of Starch in Sausage Meat. By HENRICH WELLER (*Zeit. anal. Chem.*, 1899, **38**, 375; from *Forsch. Lebensmittel*, &c., **3**, 430; *Zeit. Unters. Nahr.-Genussm.*, 1, 167).—Use is made of the solubility of starch in zinc chloride and the optical activity of the solution. 40 grams of the finely divided material are mixed with 100 c.c. of water, 0·3 gram of zinc chloride, and 0·5 gram of hydrochloric acid of sp. gr. 1·19, and heated for half an hour in boiling water. After cooling, it is made up to 200 c.c. with water, and the turbid liquid strained. Of this, 50 c.c. are mixed with 0·3 gram of zinc chloride and 0·5 gram of hydrochloric acid and heated to boiling; after cooling, it is made up to 100 c.c. with cold saturated mercuric chloride solution, by which means the optically active proteids are precipitated. The clear filtrate is then polarised in a 200 mm. tube. The different starches exhibit different rotations, 1° Ventzke corresponding with 0·37732 gram of potato starch (in 40 grams of substance), 0·40966 gram of wheat starch, or 0·48284 gram of rye starch. The variety of starch must therefore be ascertained by microscopic examination. The method does not serve for sausage meat containing liver, in consequence of the presence of glycogen and other optically active substances. M. J. S.

Detection of Maize Starch in Wheat-Flour. By KARL BAUMANN (*Chem. Centr.*, 1899, 1, 547; from *Zeit. Unters. Nahr.-Genussm.*, **2**, 27—29).—The author finds that chloral rapidly gelatinises both maize and wheat starches, and cannot therefore be successfully used for distinguishing between them. A more suitable reagent is a solution of potassium hydroxide of 1·8 per cent. strength. 0·1 gram of the suspected flour is treated in a test tube with 10 c.c. of the alkali for 2 minutes, and the alkali is then nearly neutralised by adding 4—5 drops of 25 per cent. hydrochloric acid. The wheat starch is completely gelatinised by this treatment, whilst the maize starch remains intact and may be readily recognised microscopically. Rye-flour gelatinises even more quickly than wheat-flour.

L. DE K.

Examination of Commercial Flour. By HENRY KRAEMER (*J. Amer. Chem. Soc.*, 1899, **21**, 650—663).—Details are given of micro-chemical methods for the detection of maize in wheaten flour.

Detection of Formaldehyde by Means of Phloroglucinol. By LUDWIG VANINO (*Chem. Centr.*, 1899, i, 710; from *Pharm. Centr. Halle*, **40**, 101—102).—The author (compare Abstr., 1898, **2**, 545) recommends Jorissen's phloroglucinol test for the detection of formaldehyde in milk. 8—10 c.c. of the sample are mixed with 1—2 c.c. of a 0·1 per cent. solution of phloroglucinol and a few drops of aqueous soda. A reddish coloration is noticed even when the milk contains but 4 parts of formaldehyde per million. The reaction is most pronounced with liquids containing 0·5 per cent., but if larger quantities of formaldehyde are present, the test becomes less distinct, and with more than 3 per cent. fails altogether. L. DE K.

Detection of Formaldehyde in Food Stuffs. By FERDINAND JEAN (*Chem. Centr.*, 1899, 1, 641; from *Ann. chim. anal. appl.*, 4, 41—42).—The substance to be tested is rubbed to a thin paste with water containing about one per cent. of sulphuric acid. When dealing with milk, 100 c.c. of the sample are mixed with 4 drops of sulphuric acid, heated in a 300 c.c. flask to 80° for a few minutes, and, after adding excess of dry powdered sodium sulphate, 50 c.c. are distilled. The distillate is then tested for formaldehyde. It turns red on adding a solution of magenta previously decolorised by sulphurous acid; with aqueous solution of aniline, a milky turbidity is obtained, and with Nessler's reagent a yellowish- afterwards brownish-red, precipitate is formed. Phenylhydrazine hydrochloride gives a white turbidity, and an alkaline solution of sodium nitroprusside a blue colour; these tests distinguish it from acetaldehyde which gives a reddish colour.

To make perfectly sure, the following test should be applied:—The distillate is mixed with 3 drops of sulphuric acid and ten drops of dimethylaniline and heated for 1—2 hours in a sealed tube at 40° with frequent shaking; the contents are then put into a porcelain dish, made alkaline with soda, and boiled to expel the dimethylaniline. A slight excess of acetic acid is added and then a trace of lead dioxide, when an intense blue colour will develop should formaldehyde have been present. By this process any formaldehyde which has entered into combination with proteids is also liberated. L. DE K.

Estimation of Organic Acids in Urine. By LEO STEINDLER (*Chem. Centr.*, 1899, i, 643; from *Österr. Chem. Zeit.*, 2, 70).—The sample of urine is first titrated with standard acid, using methyl-orange as indicator; this shows the point when the first traces of organic acid are being liberated. The titration is now repeated, using as indicator a solution of dimethylamidoazobenzene, which will turn red the moment the organic acids are completely liberated; the difference between the two titrations is due to organic acids, which may be conveniently expressed in terms of hydrochloric acid. The author believes that the process involves no serious sources of error.

L. DE K.

Quantitative Separation of Isovaleric and Acetic Acids. By ALFRED C. CHAPMAN (*Analyst*, 1899, 24, 114—116).—The mixed acids are carefully neutralised with sodium hydroxide, the water is distilled off under reduced pressure, and the residue dried for a short time at 100°; it is then powdered and boiled with acetone, which must contain exactly 0·5 per cent. of water, when the sodium isovalerate alone dissolves; the liquid is filtered hot, and the residue is washed with hot acetone. After distilling off the solvent, the sodium isovalerate is treated with sulphuric acid to convert it into sodium sulphate, which is then weighed; the undissolved sodium acetate is also converted into sulphate, and from the amounts of sulphate obtained the quantities of the respective acids are calculated.

L. DE K.

Wine-Vinegar. By K. Farnsteiner (*Chem. Centr.*, 1899, i, 710—711; from *Zeit. Unters. Nahr.-Genussm.*, **2**, 198—209).—Three samples of wine were mixed with one-fifth of their bulk of wine-vinegar and allowed to undergo acetous fermentation. Of each three analyses were made, one at the beginning of the experiment, one some three weeks later, and another after four months. The results, which have been tabulated, show a large decrease in alcohol and also a loss in solid matter. The amount of total fixed acidity has decreased, but as the tartaric acid remains unchanged, the loss must have been caused by the disappearance of malic acid. A volatile substance having strong reducing properties, although seemingly not an aldehyde, has been detected in four years old wine-vinegars, but not in commercial samples. L. de K.

Detection and Separation of some Unsaturated Fatty Acids. By K. Farnsteiner (*Chem. Centr.*, 1899, i, 545—547; from *Zeit. Unters. Nahr.-Genussm.*, **2**, 1—27).—*Conversion of oleic acid into elaidic acid by nitrous acid, and separation of elaidic acid from other unsaturated acids.*—Oleic acid may be separated from elaidic acid by treating the mixed lead salts with ether, in which the elaidate is insoluble; or the mixture may be treated with hot benzene, when the elaidate will separate in crystals on cooling. The best way to convert oleic acid into elaidic acid is to act on 1 gram of the acid at 10—20° with 20—25 c.c. of nitric oxide in an apparatus from which the air has been removed; an equal volume of oxygen is then introduced, and the flask is well shaken. The elaidic acid, which, however, contains about 14—18 per cent. of oleic acid, is then obtained as a bluish- or greenish-white substance which may be reduced to powder, and melts at 43°.

Estimation of oleic acid.—Dried barium oleate is practically insoluble in benzene; if 5 per cent. of 95 per cent. alcohol is added, it dissolves on boiling, but practically all deposits on cooling. The barium salts may be obtained directly by heating the fats for 15 minutes with a solution of barium hydroxide in a mixture of equal volumes of benzene and methylic alcohol.

A table is given showing the amount of saturated acids, unsaturated acids, and oleic acid in olive oil, ground-nut oil, lard, and cocoa butter.

Detection and estimation of linoleic acid.—By brominating liquid fatty acids Hazura has obtained the compounds $C_{18}H_{32}O_2Br_4$ and $C_{18}H_{30}O_2Br_6$. On reduction, the first yields linoleic acid, and the second linolenic acid. A process of estimating the tetrabrominated compound is based on its sparing solubility in light petroleum. When both occur together, they are dissolved in 50 times their weight of benzene, an equal volume of absolute alcohol is added, and the solution is titrated hot with standard alcoholic potash, with phenolphthalein as indicator. On cooling, potassium hexabromolinolenate is deposited, whilst potassium tetrabromolinoleate remains in solution.

L. de K.

Estimation of Oxalic Acid in Urine. By Ernst Salkowski (*Zeit. anal. Chem.*, 1899, **38**, 394; from *Centr. med. Wiss.*, 1899, 257).—Advantage is taken of the solubility of oxalic acid and almost complete insolubility of phosphoric acid in ether. Half a litre of urine is evaporated to one-third, mixed with 20 c.c. of hydrochloric acid of sp. gr. 1·12, and thrice extracted by shaking with 200—250 c.c. of ether containing 5—10 per cent. of alcohol. The ethereal extract is filtered through a dry filter, distilled, and after addition of water concentrated to about 20 c.c., the solution made feebly alkaline with ammonia, mixed with 1—2 c.c. of calcium chloride, and acidified with acetic acid. The precipitate of calcium oxalate is weighed in the usual manner. With a mixed diet, human urine contains 0·128 gram of oxalic acid per 100 grams of nitrogen. M. J. S.

Solubility of Calcium Tartrate. By HENRIK ENELL (*Zeit. anal. Chem.*, 1899, **38**, 368—369; from *Nordisk. farm. tid.* 1896).—At 15°, 1 part of calcium tartrate dissolves in 2630 parts of water, 3850 parts of glacial acetic acid, 296—303 parts of 25 per cent. acetic acid, 2280 to 5242 parts of concentrated potassium hydrogen tartrate solution, or 350—385 parts of 3 per cent. acetic acid saturated with potassium hydrogen tartrate. Potassium hydrogen tartrate containing calcium may be readily purified by washing with dilute acetic acid (compare Abstr., 1897, ii, 608). M. J. S.

Estimation of Uric Acid. By E. MALLET (*Zeit. anal. Chem.*, 1899, **38**, 396—397; from *Ann. chim. anal. appl.*, **4**, 82).—The uric acid is precipitated as copper salt by mixing 100 c.c. of urine with 10 c.c. of a 16 per cent. solution of sodium carbonate and taking 82 c.c. of the filtrate for the precipitation of the copper salt. The latter, after washing until free from alkali, is dissolved in 500 c.c. of water containing 5 c.c. of sulphuric acid, and titrated with *N*/10 permanganate. The number of c.c. of permanganate expresses directly the number of centigrams of uric acid per litre of urine. M. J. S.

Preparation of Homogentisic Acid and its Detection in Urine. By KARL H. HUPPERT (*Zeit. anal. Chem.*, 1899, **38**, 395—396; from *Deut. Arch. klin. Med.*, **64**).—The urine, concentrated to one-sixth, is shaken with $1\frac{1}{2}$—2 vols. of ether; the residue from the ethereal extract is dissolved in water, and the boiling solution precipitated by a copious addition of lead acetate, the dark coloured precipitate being immediately removed by filtration. The crystals, which will have deposited from the filtrate by the following day, are collected, washed well with water, and treated with hydrogen sulphide in boiling water. The solution is freed from hydrogen sulphide by heating to 55—60° in a vacuum, and the precipitation with lead acetate, &c., repeated until a white lead salt is obtained. The acid solution obtained from this deposits crystals when concentrated in a vacuum over sulphuric acid. A further quantity may be obtained from the mother liquor of the first crop of crude lead salt by treating with hydrogen sulphide, concentrating the filtrate, triturating with solid lead acetate, and washing the paste on a suction filter, first with a saturated lead acetate solution, and then with water. This precipitate is then purified as before.

On moistening the solid acid with potash solution and allowing access of air, the crystals become surrounded with a dark green border which persists as long as any of the substance remains undissolved, and passes then into brown. If the crystals are completely immersed in the liquid, the brown coloration is obtained at once. A solution of the crystals in methylic alcohol treated with sodium methoxide exhibits a blue colour in thin layers (compare Abstr., 1897, ii, 576; 1891, 1129; 1892, 925). M. J. S.

Composition of Milk and Milk Products. By HENRY DROOP RICHMOND (*Analyst*, 1899, **24**, 197—201. Compare Abstr., 1897, ii, 511).—The paper deals with a large number (over 29,000) of samples of milk analysed in the laboratory of the Aylesbury Dairy Co. in 1898.

The standards for milk again prove to be fair, as most of the samples were much above the requirements in every constituent; a few gave non-fatty solids so low that, judging by these only, they might have been condemned as containing 5—6 per cent. of water, but it was ascertained that the deficiency was mainly in milk-sugar, the more important constituents—fat, proteids, and ash—being present in normal quantity. No sample which falls a little below the accepted standard should be condemned unless the proteids and ash are also rather low. Vieth's ratio for sugar, proteids, and ash of 13 : 9 : 2 was again practically confirmed.

An analysis of cream shows the great variation in the composition of this article, but it seems that the non-fatty solids contain the usual proportion of milk sugar, which fact upsets Storch's evidence for the presence of a new proteid in milk (Abstr., 1897, ii, 420).

Analyses of butter are communicated, showing that the refractive index at 35° varies from 46—47°; a butter prepared in the Channel Islands gave, however, the figure 43·8°.

Interesting analyses are given of so-called "putrid slime," which is in reality a product from milk deposited on the sides of the drum of a separator: *Solids* (of one of the three samples examined), 29·2; *fat*, 1·3; *milk solids*, calculated, 7·2; other *non-fatty solids*, 17·5; *ash*, 3·2, including 1·28 P_2O_5. This substance, although also containing any dirt present in the milk, is no doubt largely composed of Storch's mucoid. Its average quantity in milk amounts to about 0·032 per cent. L. DE K.

Milk Analysis. By LEONARD DE KONINGH (*Analyst*, 1899, **24**, 142—146).—*Analysis of sour milk.*—If this is not too much decomposed, the sp. gr. may be taken with a milk-hydrometer, the sample being previously liquefied by adding 5 c.c. (or more) of a solution of sodium hydroxide of sp. gr. 1·03 to 95 c.c. of the sample. If the sp. gr. of the mixture should differ much from 1·030, a correction should be made by deducting from the gravity found (excess over 1000) 1·5, and dividing the difference by 0·95. As, however, milk loses in gravity by addition of alkali, the author suggests the addition of 0·8 to the gravity obtained. The alkaline milk may be used for the estimation of the fat in the Leffmann-Beam apparatus, allowance being made for the slight dilution.

Detection of cane sugar.—As the ordinary non-fatty solids process may fail where cane-sugar has been added to mask the adulteration, it is suggested that all samples should be tested for cane sugar by a slightly modified form of Cotton's molybdic acid process; 10 c.c. of the milk are mixed with 2 c.c. of a cold saturated solution of pure ammonium molybdate and 8 c.c. of dilute hydrochloric acid (1 : 8), and the mixture heated for 5 minutes at 80°. A blue coloration is developed if the sample contains 5 per cent. or more of added sugar solution of sp. gr. 1·0308. If the milk is very stale, the test is less satisfactory.

Detection of boric acid.—100 c.c. of the sample are heated to boiling in a large beaker covered with a light dish containing cold water; the flame is at once removed and 8 c.c. of dilute nitric acid (1 part of fuming acid diluted to 50 parts) added; the coagulum which forms will occupy about 8 c.c. When cold, the liquid is filtered through muslin, 80 c.c. are collected, and 0·8 gram of dry sodium carbonate added; the whole may now be rapidly evaporated and burnt in a large platinum dish, and the portion soluble in water then tested for boric acid by any recognised process. L. DE K.

Possible Source of Error in Modifications of the Leffmann-Beam Method for the Estimation of Fat in Milk. By HENRY DROOP RICHMOND and F. R. O'SHAUGHNESSY (*Analyst*, 1899, **24**, 146—148).—In the original process devised by Leffmann and Beam, the milk was mixed with a solution consisting of equal volumes of amylic alcohol and hydrochloric acid, and finally with sulphuric acid. In a modification of this process devised by Gerber the use of hydrochloric acid is omitted. From the results of a series of experiments the authors conclude that Gerber's method, when carefully practised, generally gives good results, but may at times lead to error, particularly in hot weather. They also show the advisability of first adding the sulphuric acid, next the milk, and then the amylic alcohol. If the acid and amylic alcohol are added first, a mixture is obtained which, when diluted with milk, throws up an amylic compound, by which the layer of fat may become sensibly increased in volume.

L. DE K.

Estimation of Fat in Milk, using Light Petroleum as a Solvent. By HENRY DROOP RICHMOND and C. H. ROSIER (*Analyst*, 1899, **24**, 172—174).—The authors prefer using light petroleum instead of ether in milk analyses, as it is insoluble in aqueous liquids. To properly extract the fat, the operation should be conducted as follows: 9 c.c. of 91 per cent. sulphuric acid are measured into a tube holding 50 c.c. and constricted just above the point to which 20 c.c. reaches; 10 grams of milk are introduced without mixing it with the acid, and 0·9 c.c. of amylic alcohol is then added, and the whole well shaken. When cooled to 25°, 20 c.c. of light petroleum are added, and the mixture is again thoroughly shaken two or three times. When separation is complete, the petroleum is blown off into a tube containing 20 c.c. of water, with which it is shaken to remove traces of acid; the acid liquid is washed with a little more light petroleum, which is added to the main bulk. The fat solution is finally blown off into a tared flask, and the light petroleum, which should boil below 80°, is then distilled off and the residual fat dried and weighed. L. DE K.

Apparatus for Estimating Total Solids and Fat in Milk. By S. SONN (*Zeit. anal. Chem.*, 1899, **38**, 353).—An aluminium boat with a cover is charged with about 2 grams of cotton-wool freed from fat, and is then dried and weighed. Twenty c.c. of the milk are dropped upon the wool, the boat is reweighed and dried in an oven until constant in weight. It is then slipped into a cylindrical metal (nickel-plated) cylinder, closed at the bottom, and furnished with an internal self-starting syphon, the bend of which is a little higher than the upper end of the boat. This cylinder fits loosely into a glass tube, narrowed at its lower end for passing through the cork of the flask in which the fat solution is to be received, and is fitted with a condenser. The extraction proceeds in the same manner as with a Soxhlet extractor, and when it is complete the boat is redried and the amount of fat ascertained from the loss of weight. M. J. S.

Physical and Chemical Constants of Butter-Fat. By C. A. BROWNE (*J. Amer. Chem. Soc.*, 1899, **21**, 612—633).—The results of a large number of analyses of genuine butter fats are given. The figures include the sp. gr. at 40° (water at 15·5°), the melting point, the acid number, the saponification number, the ether number, the iodine number, the Reichert and Reichert-Meissl numbers, the insoluble acids per cent., the acetyl number, the glycerol, the total and soluble fatty acids, the sp. gr. of the insoluble acids at 20° (water at 20°), the melting point of the insoluble acids, the saponification number of the insoluble acids, the mean molecular weight of the insoluble acids, the sp. gr. of the soluble acids at 20° (water at 20°), the saponification number of the soluble acids, and the mean molecular weight of the soluble acids.

Full particulars as to the methods of determining these constants are given. The results show the great variation in composition of butter-fats, chiefly due to the quality of the cattle food, and many a genuine butter might be condemned as containing margarine; if, however, prepared from the mixed milk of a large herd of cows, there is less danger of this happening.

The author points out the importance of not heating the butter above 50° when preparing the butter-fat for analysis. L. DE K.

Butter and its Adulterations. By C. B. COCHRAN (*Chem. Centr.*, 1899, i, 709—710; from *J. Franklin Inst.*, 1898, **147**, 85—97).—The author states (compare Abstr., 1898, ii, 198) that in eastern Pennsylvania about 5 per cent. of cotton seed oil (sold under the name of "cream ripener") is added during the churning to increase the yield of butter or rather to make this hold more water. This fraud may be readily detected by the Bechi test. Another fraud now frequently practised consists in melting stale, unsaleable butter and then rechurning the clarified fat with the fresh milk or buttermilk, the resulting product being sold as fresh butter. If otherwise unadulterated, this sophistication may be detected chemically by the high percentage of free acidity and physically by Valenta's acetic acid test as the critical point or turbidity temperature is lowered from 60° to about 50°; also when applying Jean's modification of this test, the amount of acetic acid required will be raised in the proportion of 7 to 10. The fraud may also be detected microscopically, using polarised light. Fresh butter is amorphous, and the field is dark and even. Butter which has been melted is more or less crystalline, and presents an uneven, spotted field. L. DE K.

Cryoscopic Examination of Butter and Margarine. By POURET (*Bull. Soc. Chim.*, 1899, [iii], **21**, 738—740).—By the cryoscopic method, using benzene as solvent, the author has determined the molecular weight of various samples of the fat of pure butter and finds that it lies between the limits 631 and 662, whilst that of margarine is practically constant between 840 and 860. A determination of the molecular weight of a sample of butter-fat thus renders it possible to ascertain rapidly whether margarine is present as an adulterant, since 15 per cent. of the latter increases the molecular weight by 30—35 units, an amount greater than the extreme variation observed by the author amongst pure butters. The presence of "vegetaline," the fat obtained from cocoa-nut oil, which is often used to adulterate butter, cannot, however, be detected by this method, as the cocoa-fat has a molecular weight lying within the limits of the values obtained for pure butter-fat. W. A. D.

Paraffin as an Adulterant of Oleomargarine. By JOSEPH F. GEISLER (*J. Amer. Chem. Soc.*, 1899, **21**, 605—608).—Solid paraffin frequently occurs in margarines; it is added, not to cheapen the article, but to improve its appearance.

Any quantity above 2 or 3 per cent. may be detected as follows: 2·5 grams of the sample are saponified with 20 c.c. of alcohol containing 1 gram of potassium hydroxide, and an equal volume of water is then added; the paraffin will collect on the surface, and may then be further identified. Large quantities will betray their presence by the abnormally low sp. gr. of the sample at 100° F., and by its not giving a clear liquid on saponification.

The fraud may also be detected with the aid of the microscope; two photomicrographs are given in illustration. The author states that no proofs have as yet been brought forward to show that paraffin, even when diluted with butter-fat, is harmless to the system.

L. DE K.

Iodine Absorption of Commercial Tallow. By ALFRED SMETHAM (*J. Soc. Chem. Ind.*, 1899, **18**, 330—331).—The author shares the views of many authorities that the iodine absorption figure offers the most trustworthy method of ascertaining the value of tallow and similar fats for candle or soap making. In using Hübl's test, it is important to use absolute alcohol and to keep the solutions of the iodine and the mercuric chloride separate. As a good deal depends on the length of time of action, the author now allows the iodine to act on the fats for 18 hours.

A table is given showing the iodine absorption figure of a large number of tallows of different kind and origin. L. DE K.

Saponification Value of Fish-Oils. By WILHELM FAHRION (*Chem. Centr.*, 1899, i, 645—646; from *Chem. Rev. Fett. Harz.-Ind.*, **6**, 25—29).—The saponification number of fish oils is not constant. Sardine oil, for instance, gives numbers varying from 185—199, and stickleback oil from 178—210. The saponification may be effected by boiling with alcoholic potash, or in the cold by dissolving in light petroleum and adding alcoholic soda; in this case, it is important to dissolve the soda in absolute alcohol.

Oils with a high iodine number, excepting haddock oil, give too high and irregular results, as they are decomposed by excess of alkali into fatty acids with a lower molecular weight; there is, however, no such danger when the author's method for taking the inner saponification number is used (Abstr., 1898, ii, 654).

Fatty acids may be prevented from undue oxidation, caused by long heating at 100°, by evaporating their solutions in light petroleum to dryness in several platinum dishes and drying the residue for half an hour on the water-bath; in presence of any water, the residue should first be moistened with a little absolute alcohol. L. DE K.

The Iodine Number of Linseed Oil. By J. J. A. WIJS (*Chem., Centr.*, 1899, i, 646; from *Chem. Rev. Fett. Harz.-Ind.*, **6**, 29—31). —The author has determined the iodine number of a large number of linseed oils of undoubted purity and freshness by means of his new process with iodine chloride and acetic acid (Abstr., 1898, ii, 412).

The results of other authors are confirmed as to the quality of the oil varying with the source of the seed. Oil pressed from Dutch seed showed an iodine number of 193—201; from East Indian seed, 182—187; from La Plata seed, 174—182; from North American seed, 177—188; from Baltic provinces, 192—200; from Central Russia, 188—189; from Black Sea districts, 176—182; from Danube districts, 182.

The iodine number increases with the sp. gr. of the sample, which is determined commercially by the aid of Fischer's instrument.

L. DE K.

Maize Oil (Corn Oil). By LEONARD ARCHBUTT (*J. Soc. Chem. Ind.*, 1899, **18**, 346—347).—The author has tested an authentic sample of maize oil with the following results: Sp. gr., 0·9243 at 15·5°; absolute viscosity, 0·789 at 15·5°; Maumené test using acid containing 97 per cent. of hydrogen sulphate, 81·6°; saponification value, 18·97; iodine absorption figure, 122·7; unsaponifiable matter, 1·69 per cent., and free acid calculated as oleic acid, 2·4 per cent.

From these figures, and also from practical drying tests, it may be concluded that maize oil is a semi-drying oil, rather more strongly drying than cotton seed oil, and that it must be considered unfit for lubricating purposes. L. DE K.

Composition of the Fatty Oil of Cedar Seeds. By D. KRYLOFF (*Chem. Centr.*, 1899, i, 592; from *J. Russ. Chem. Soc.*, 1898, **30**, 924—926).—A sample of commercial Siberian cedar seed oil, solidified at 20°, had a sp. gr. 0·9326 at 0°/0°, iodine number 149·5—150·5, Reichert-Meissl number 2·0, Hehner number 93·33, saponification coefficient 191·8, and acid coefficient 1·09. The elaidin test showed the presence of a small quantity of olein. The crystalline acids precipitated from the oil, when purified, melted at 63°, and had the composition of palmitic acid; the filtrate, when treated with potassium permanganate by Saytzeff's method (*J. Russ. Chem. Soc.*, **17**, 419), yields the tetrahydroxystearic acid melting at 165° obtained from linseed oil by Reformatsky, and a substance which melts at 140° and is probably dihydroxystearic acid. Cedar seed oil is therefore very similar to linseed, hempseed, and other fatty oils, resembling the first particularly in respect to its content of unsaturated acids. Its content of linoleic acid is about the same as that of the drying oils.

E. W. W.

Cacao Butter. By JULIUS LEWKOWITSCH (*J. Soc. Chem. Ind.* 1899, **18**, 556—558).—The Reichert-Meissl value of cacao butter has been recorded as 3·52, but the author states that it varies from 0·20 to 0·83. The adulteration with large quantities of cocoa-nut oil or palm-nut oil may therefore be detected by the large increase of volatile soluble fatty acids.

Filsinger has stated that when two grams of cacao butter are dissolved in 6 c.c. of a mixture of 4 parts of ether and 1 part of alcohol, the solution remains clear when cooled to 0°, whilst the presence of as little as 5 per cent. of tallow causes crystallisation. The author states that this test is apt to mislead, as some undoubtedly genuine samples deposited crystals at 9°, and some even at 12°. When the adulteration with tallow has been practised to the extent of more than 10 per cent., the tallow crystals may be readily recognised by the microscope, as they appear like curved tufts somewhat of the shape of an "*f*," the ends of the *f* resembling horse-tails, whereas cacao butter crystals have the appearance of densely-packed clusters of needles radiating in all directions from a common centre. Unfortunately, when less than 10 per cent. of tallow is present, the tallow crystals lose much of their characteristic appearance.

A better proof of the adulteration with tallow or similar fats is the presence of cholesterol, which is readily isolated and recognised microscopically.

The author also states that although cacao butter does not readily turn rancid if properly kept, it will turn quite as rancid as any other fat under very unfavourable conditions, and it then acquires a nauseous taste and smell.

L. DE K.

Testing of Oil and Spirit of Mustard. By JOHANNES GADAMER (*Arch. Pharm.*, 1899, **237**, 372—378).—The method previously described (this vol., ii, 455, where *for* 4·5 *read* 4·65), does not always give trustworthy results. It is assumed that the allylthiocarbimide is first converted into allylthiocarbamide, $CS{:}NC_3H_5 + NH_3 = NH_2{\cdot}CS{\cdot}NHC_3H_5$, from which the silver nitrate then abstracts hydrogen sulphide with formation of silver sulphide and allycyanamide, $NH_2{\cdot}CS{\cdot}NHC_3H_5 + 2AgNO_3 + 2NH_3 = Ag_2S + CN{\cdot}NHC_3H_5$; $2AgNO_3$ is thus removed from solution for each mol. of thiocarbimide originally present. It is quite possible that some of the compound $NH_2{\cdot}CS{\cdot}NHC_3H_5,AgNO_3$ (Abstr., 1896, i, 140) may be deposited, and only slowly undergo further decomposition; if so, only $1AgNO_3$ would be removed per mol. of the thiocarbamide as regards a portion of the latter, and this would affect the result of the titration. Now it is conceivable that this source of error might be avoided by using a larger excess of silver nitrate, when the compound $NH_2 \cdot CS \cdot NHC_3H_5,2AgNO_3$ (*loc. cit.*) might be deposited instead, and as this requires $2AgNO_3$ per mol. of the thiocarbimide, the titration would not be affected; as a matter of fact, it was found that a larger excess of silver nitrate is beneficial, and the method is to be modified as follows: Of the spirit of mustard, 5 c.c. (=4·2 grams) are allowed to remain with 50 c.c. of $N/10$ silver nitrate solution and 10 c.c. of officinal ammonia solution (German pharmacopœia) for 24 hours in a well stoppered, graduated flask of 100 c.c. capacity, the flask being shaken frequently. After dilution to the mark, 50 c.c. of the clear filtrate, mixed with 6 c.c. of officinal nitric acid and 1 c.c. of ferric ammonium sulphate solution, must require not more than 17·15 and not less than 16·6 c.c. (?16·5) of $N/10$ ammonium thiocyanate solution to produce a red coloration. This corresponds with 92·5—100 per cent. of $CS{:}NC_3H_5$ in the oil.

Experiments with oils from different sources are quoted, and the conclusion is drawn from them that the percentage of sulphur assigned by Grützner (this vol., ii, 530) to the pure natural oil is too low; it is, perhaps, admissible to replace the number 17·15 by 17·2 c.c., in order to allow a somewhat wider margin. C. F. B.

Volumetric Estimation of Aniline. By MAURICE FRANÇOIS (*J. Pharm.*, 1899, [vi], **9**, 521—524).—The principle of the method depends on the fact that, if bromine water is added to an aniline solution which contains a little sulphate of indigo as indicator, the bromine does not act on the indigo until all the aniline has been converted into tribromaniline. The bromine water (5 grams bromine in 1000 c.c. water) is standardised by means of an aqueous solution of aniline hydrochloride, which contains 1·392 grams of the pure salt in 1000 c.c. (1 c.c. = 0·001 aniline). The bromine water, if exposed to the air, is continually losing bromine; it is therefore essential (1) to use a burette of such capacity that it contains enough bromine water for both the standardisation and estimation without refilling; (2) to close the end of the burette with a plug of cotton wool; (3) to find approximately the number of c.c. of bromine water required, and then, in the final titration, to add nearly the whole at once, in order to avoid the slight loss of bromine which occurs when drops of the solution fall through the air. The method may be applied to solutions containing aniline or its hydrochloride, the presence of ammonium chloride does not vitiate the result, and, finally, if the solution to be titrated contains mineral substances which would react with the bromine, the aniline may be liberated by potash and distilled in steam. The degree of dilution of the aniline solution does not influence the result.

H. R. LE S.

Volumetric Estimation of Alkaloids. By ELIÉ FALIÈRES (*Compt. rend.*, 1899, **129**, 110—111).—The estimation of alkaloids by titration with an acid is in many cases unsatisfactory, because the colour change of the indicator is not sharply defined, and also is more or less masked when, as is often the case, the alkaloidal solutions are coloured. To obviate these and other difficulties which are experienced when ordinary indicators are used, the author employs an ammoniacal solution of copper as indicator; the point of neutralisation is then made evident, not by a colour change, but by the precipitation of copper oxide, which is most readily seen. The copper solution is prepared by dissolving 10 grams of copper sulphate in about 500 c.c. of water, adding ammonia until the precipitate first formed is nearly all dissolved, filtering, and diluting to a litre. This solution is titrated by means of decinormal sulphuric acid. For an estimation, 0·1 gram of the alkaloid is dissolved in 20 c.c. of decinormal sulphuric acid, the flask placed on a black surface, and the ammoniacal copper solution added until there is a persistent turbidity in the liquid. The volume of copper solution used corresponds with the amount of sulphuric acid uncombined with the alkaloid, and, therefore, the amount of acid combined with the alkaloid is readily calculated. In estimating the total alkaloids in cinchona bark by this method, the colouring matter need not be removed before titration. H. R. Le S.

A New Method for the Estimation of Morphine in Opium. By Harry M. Gordin and Albert B. Prescott (*Arch. Pharm.*, 1899, **237**, 380—384).—The method described previously (this vol., i, 90) has been modified in so far that the maceration of the drug with the ammoniacal mixture is continued for 5—6 instead of 3 hours, and the evaporation of the liquid is effected at the ordinary temperature in a good draught. Further, the morphine is extracted by percolation with a mixture of chloroform and absolute alcohol (5 : 1 by volume) instead of with acetone, and the evaporation of the solvent is again effected in a good draught; an excellent percolator for this purpose is obtained by cutting off the upper 3/5 of a 50 c.c. burette, and using the lower part with a plug of cotton-wool placed above the stopcock.

An alkalimetric estimation may also be employed, either alone or combined with the iodometric one. In this case, 3 grams of the drug are treated just as in the other method up to the evaporation of the chloroform–alcohol mixture. The residue of morphine is then ground with 50 c.c. of *N*/20 sulphuric acid, and rinsed with water into a tall, narrow measuring cylinder, the whole diluted to 90 c.c., shaken, and allowed to settle for a time, after which 75 c.c. are filtered into a beaker and mixed with 30 or 35 c.c. of *N*/20 caustic potash, the excess of the latter being titrated finally with *N*/20 acid; the number of c.c. of acid neutralised by the morphine, multiplied by 0·568, gives the percentage of morphine in the opium. The indicator used is filter paper, dyed a pale yellow with neutral methyl-orange solution, and it is dipped for about 10 seconds in the liquid; the acid and alkali must be standardised under conditions similar to those of the estimation. If it is desired to control the result by an iodometric estimation, the titrated liquid is mixed with 3—4 grams of calcium hydroxide, diluted to 250 c.c., and shaken vigorously and frequently during an hour; 50 c.c. are then filtered into a 100 c.c. graduated flask, acidified, treated with excess of *N*/10 iodine solution, and titrated with thiosulphate, just as described in the previous paper; the weight of iodine used, multiplied by 150, gives the percentage of morphine.

In a sample of opium 17·66—17·90 per cent. of morphine were found by the alkalimetric and 17·49—17·50 by the iodometric method, but by the gravimetric method only 14 per cent. were found.

C. F. B.

Separation of Brucine from Strychnine. By Willem Stoeder (*Chem. Centr.*, 1899, i, 506; from *Ned. Tydschr. Pharm.*, 11, 1—5).—The separation of brucine from strychnine by means of potassium ferrocyanide in a sulphuric acid solution is untrustworthy. Good results are obtained by Keller's method (Abstr., 1894, ii, 491). The crude alkaloids, weighing about 0·3 gram, are dissolved in 10 c.c. of 10 per cent. sulphuric acid, 1·5 c.c. of 50 per cent. nitric acid is added, and the mixture left for 1½ hours. The brucine is thus converted into dinitrobrucine, and the strychnine may be recovered by agitating the liquid with chloroform, after rendering alkaline with ammonia.

L. de K.

A New Test for Cocaine. By George L. Schaefer (*J. Amer. Chem. Soc.*, 1899, 21, 634—635).—The following test is suggested for detecting the presence of the other coca alkaloids in cocaine, and is preferable to McLagan's permanganate test.

0·05 gram of the commercial cocaine hydrochloride is dissolved in 20 c.c. of water, mixed first with 5 c.c. of a 3 per cent. solution of chromic acid, and then with 5 c.c. of a 10 per cent. solution of hydrochloric acid, and the solution cooled to 15°. If the sample is pure, a clear solution will result, but if more than traces of the other coca alkaloids are present, the solution becomes cloudy at once, or in a few minutes.

L. de K.

Reactions of Indole Bases and of Proteids. By Julius Gnezda (*Compt. rend.*, 1899, 128, 1584—1587).—On fusing oxalic acid with a trace of indole, a sublimate and residual mass of a splendid purple colour are obtained, and on dissolving in water, a coloured solution is formed which is only slightly changed by the addition of potash; 2′-methylindole, scatole, and 1′-methylindolecarboxylic acid behave similarly, whilst 2′-phenylindole gives a greenish-yellow sublimate, changing to black. Phthalic, isophthalic, or terephthalic acid, when fused with indole, 2′-methylindole, scatole, or 1′-methylindolecarboxylic acid, yields a faintly violet sublimate; 2′-phenylindole is coloured green and violet by phthalic and terephthalic acids respectively, but gives no colour with isophthalic acid. Malonic, succinic, and glutaric acids give slightly red products with indole, 2′-methylindole, scatole, and 1′-methylindolecarboxylic acid, the intensity of the coloration diminishing as the number of CH_2-groups increases.

On adding albumin, peptones, or gelatin to fused oxalic acid, a pinkish sublimate is obtained; green colorations are formed with glycocholic, taurocholic, and cholic acids, and with bilirubin, whilst with other substances of animal origin such as leucine, tyrosine, the xanthine bases, urea, neurine, glycocine, sugars, &c., indefinite brownish-yellow products are formed. Alloxanthin gives a characteristic red colour with fused oxalic acid.

Proteids give faint orange colorations with malonic, succinic, glutaric, and the phthalic acids, and the latter give slightly yellow masses with cholic acid.

Scatole, 1′-methylindolecarboxylic acid, and an alcoholic solution of indole, give orange colorations with hydrofluoric acid, whilst 2′-phenylindole is turned slightly yellow, and 2′-methylindole violet; hot hydrofluosilicic acid acts similarly. A very persistent red colour is obtained on heating hydrofluosilicic acid with a concentrated solution of peptone, gelatin, or albumin; the albumin must be heated until peptonisation is complete.

When albumin (white of egg) is subjected to prolonged treatment with concentrated hydrochloric acid, the products formed give characteristic indole reactions. T. H. P.

Detection of Albumin in Urine. By Gabriel Guérin (*J. Pharm.*, 1899, [vi], 9, 576).—A 10 per cent. aqueous solution of di-iodoparaphenolsulphonic acid (sozoiodol) is a very delicate reagent for the detection of albumin in urine. 10—15 drops of the reagent when added to 8 or 10 c.c. of the filtered urine produce a whitish, flocculent precipitate or a milky turbidity if albumin is present. Albumoses, peptones, and most alkaloids are also precipitated by it, but their precipitates readily dissolve on heating, whereas that produced by albumin is completely insoluble. Alkaline urates and uric acid are not precipitated by this reagent. H. R. Le S.

Estimation of Albumoses and Peptones. By Jean Effront (*Bull. Soc. Chim.*, 1899, [iii], 21, 680—683).—The method of analysis is based on the author's observations on the influence of acidity on the solubility of proteoses in alcohol (this vol., i, 835). 50 c.c. of a 5 per cent. solution of the crude peptone are neutralised with $N/10$ sodium hydroxide, left for 2 hours, and the precipitate of syntonin washed with water and alcohol, dried at 100°, and weighed. Another 50 c.c. of the 5 per cent. solution are neutralised with normal caustic soda, diluted with water to 55 c.c., and filtered after some time; 44 c.c. of the filtrate, corresponding with 40 c.c. of the original solution, are mixed with 8 c.c. of normal hydrochloric acid and 250 c.c. of 95 per cent. alcohol, the clear alcoholic solution is neutralised by adding 8 c.c. of normal soda, and the precipitated albumoses are finally collected and dried at 100°. The peptone, together with mineral matter, is obtained by evaporating the filtrate. The application of this process to the products of the peptic digestion of fibrin at various stages shows that it yields accurate and consistent results; it is also very expeditious. N. L.

General and Physical Chemistry.

Refractive Indices and Densities of Normal and Semi-normal Aqueous Solutions of Hydrogen Chloride and the Chlorides of the Alkalis. By Sir John Conroy (*Proc. Roy. Soc.*, 1899, **64**, 308—318).—A number of refractive indices have been determined by the hollow prism method, special care being taken to keep the temperature of the prism at 18°; this was effected by a water jacket which was in contact with the prism above, below, and, as far as possible, on the faces.

The refractive indices and densities of normal and semi-normal solutions of the chlorides of hydrogen, lithium, sodium, potassium, and rubidium increase, as a rule, with the molecular weight; solutions of potassium chloride are exceptional, for their indices are less than those of the corresponding sodium chloride solutions. It is shown that whilst a litre of a normal solution of hydrogen, lithium, or sodium chloride contains nearly the same weight of water, a litre of a normal solution of potassium chloride contains about 10 grams less water than a litre of normal sodium chloride solution. Thus the water in a normal potassium chloride solution may be regarded as less dense than in a normal sodium chloride solution. Allowing for this decrease of density, the difference between the refractive indices of water thus calculated and the observed refractive indices of the solutions increases regularly with the molecular weight, potassium chloride no longer being an exception. The increase, however, has no apparent relation to the increase of molecular weight.

The change of the refractive index with temperature has been determined for the above solutions between 10° and 20°. J. C. P.

Simple Method of Reversing the Sodium Spectrum. By H. Kreusler (*Chem. Zeit.*, 1899, **23**, 37).—When a sodium chloride bead is held in the flame, a small dark "aureole" is observed just above the glowing bead, and as this aureole consists of dense sodium chloride vapour at a relatively low temperature, it may readily be employed for absorption. A piece of platinum wire is bent in such a way as to form two double loops, the lower parts of which hold beads of sodium chloride, whilst the upper and larger parts serve to increase the space occupied by the sodium chloride vapour. The whole is held with the beads hanging downwards in the flame of a spirit lamp, placed between an Auer's burner and the spectroscope, and is so arranged that the beads cover one another in the field of vision. In the upper half of the spectrum, the sodium lines are observed as extremely bright, in the lower half as dark lines. J. J. S.

Spectrum of the Corona. By Sir Norman Lockyer (*Proc. Roy. Soc.*, 1899, **64**, 168—170).—According to Nasini, the spectrum of the gases collected at the solfatara of Pozzuoli probably contains the characteristic green line of the corona. This and one of the other chief lines of the spectrum of the corona appear to coincide with enhanced lines of iron. It is doubtful, however, whether this coincidence is real, because the other lines in the corona are not coincident with enhanced iron lines. Careful examination of eclipse photographs obtained in 1893, 1896, and 1898 shows, in fact, that the coincidence is only approximate, and that the lines in question probably belong to some undiscovered gas or gases. J. C. P.

Chemical Classification of the Stars. By SIR NORMAN LOCKYER (*Proc. Roy. Soc.*, 1899, **65**, 186—191).—Comparison of stellar spectra with those of numerous elements at different temperatures (compare Abstr., 1898, ii, 2) has led to a classification of stars according to their temperature, the order of temperature being deduced from the character of their spectra. The hottest stars have the simplest chemistry, and in a series of stars from the highest temperatures to the lowest, the chemical forms indicated by the spectra become gradually more complex. On the idea that in this increasing complexity of stellar chemical forms an inorganic evolution may be traced similar to the organic evolution shown by successive geological strata, stars have been divided into a number of genera, the form of terminology being analogous to that adopted in geological classification. The simplest types are supplied by the proto-hydrogen and cleveite-gas stars, proto-hydrogen being that form of hydrogen which gives enhanced lines (*loc. cit.*); as the temperature falls, the stars are of the order proto-metallic or metallic, and the lowest temperature stars have fluted spectra. J. C. P.

Presence of Oxygen in the Atmospheres of certain Fixed Stars. By DAVID GILL (*Proc. Roy. Soc.*, 1899, **65**, 196—206).—The spectra of β Crucis, β and ϵ Canis Majoris and probably β Centauri are all practically identical, and contain, in addition to the hydrogen and helium lines, the stronger oxygen lines, a probable magnesium line, a probable carbon line, and three unknown strong lines.
J. C. P.

Specific Rotatory Power and Position Isomerism. By PHILLIPE A. GUYE and A. BABEL (*Chem. Centr.*, 1899, i, 466; from *Arch. Sci. phys. nat. Genève*, [iv], **7**, 23—42).—The specific rotatory powers of substituted derivatives of amylic benzoate and of aniline have been determined, and the influence of the substituent studied. The amylic benzoate derivatives are liquid, and were examined in the pure state; the aniline derivatives were examined in solution. The amylic alcohol used in the preparations had $[\alpha]_D - 4{\cdot}4°$ to $-4{\cdot}5°$.

Amylic orthonitrobenzoate, b. p. 238° under 69 mm. pressure, sp. gr. 1·135 at 17°, n_D 1·5132, $[\alpha]_D - 0{\cdot}61°$ at 17°, $+0{\cdot}90°$ at 75°; *metanitrobenzoate*, b. p. 223—225° under 52 mm. pressure, sp. gr. 1·144 at 19°, n_D 1·5187, $[\alpha]_D + 5{\cdot}85°$ at 19°, $+4{\cdot}28°$ at 75°; *paranitrobenzoate*, b. p. 250—252° under 80 mm. pressure, sp. gr. 1·140 at 17°, n_D 1·5203, $[\alpha]_D + 6{\cdot}93°$ at 17°, $+4{\cdot}82°$ at 75°; *orthobromobenzoate*, b. p. 285—287° under 730 mm. pressure, sp. gr. 1·279 at 16°, n_D 1·5243, $[\alpha]_D + 1{\cdot}88°$ at 16°, $+1{\cdot}43$ at 75°; *metabromobenzoate*, b. p. 286—289° under 737 mm. pressure, sp. gr. 1·285 at 17°, n_D 1·5243, $[\alpha]_D + 2{\cdot}70°$ at 16°, $+1{\cdot}99°$ at 75°; *parabromobenzoate*, b. p. 287—290° under 724·3 mm. pressure, sp.

gr. 1·288 at 16°, n_D 1·5282, $[\alpha]_D + 3·18°$ at 16°, $+2·35°$ at 75°; *orthamidobenzoate*, b. p. 192—194° under 41 mm. pressure, sp. gr. 1·047 at 17°, n_D 1·5364, $[\alpha]_D$ 5·98° at 17°, $+4·99°$ at 75°; *metamidobenzoate*, b. p. 184—187° under 35 mm. pressure, sp. gr. 1·051 at 18°, n_D 1·5351, $[\alpha]_D + 4·95°$ at 18°, $+4·30°$ at 75°; *paramidobenzoate*, m. p. 27—30°, b. p. 215° under 35 mm. pressure, sp. gr. 1·050 at 75°, n_D 1·5369 at 75°, $[\alpha]_D + 4·19°$ at 75°; *metatoluate*, b. p. 266—268° under 725 mm. pressure, sp. gr. 0·976 at 20°, n_D 1·4929, $[\alpha]_D + 5·05°$ at 20°.

The following derivatives of aniline and toluidine were examined in 5 per cent. pyridine solution. *Tartaryl anilide*, m. p. 250°, with decomposition, $[\alpha]_D + 259°$; *orthotoluidide*, m. p. 200°, with decomposition, $[\alpha]_D + 239°$; *metatoluidide*, m. p. 182°, with decomposition, $[\alpha]_D + 233°$; *paratoluidide*, m. p. 230°, with decomposition, $[\alpha]_D + 239°$.

The rotatory powers of the following derivatives of valeric acid were determined in 10 per cent. alcoholic solution. The valeric acid used in their preparation had $[\alpha]_D + 11·12°$ at 15°. *Valeryl anilide*, m. p. 95—96°, $[\alpha]_D + 10·5°$; *orthotoluidide*, m. p. 68—70°, $[\alpha]_D + 9·3°$; *metatoluidide*, m. p. 60—61°, no appreciable rotation; *paratoluidide*, m. p. 69—71°, $[\alpha]_D + 19·1°$.

The following malic acid derivatives were examined in 5 per cent. pyridine solution. *Malyl anilide*, m. p. 198°, $[\alpha]_D - 101·1°$; *orthotoluidide*, m. p. 179°, $[\alpha]_D - 61·8°$; *metatoluidide*, m. p. 153°, $[\alpha]_D - 75·9°$; *paratoluidide*, m. p. 206°, $[\alpha]_D - 92·5°$.

In all cases except that of amylic orthonitrobenzoate, the rotatory power falls with rising temperature. The molecular refractions of the compounds investigated are a little higher than the values calculated with the help of Conrady's coefficient. The molecular volumes of the amylic benzoate derivatives are all higher than the values calculated according to I. Traube. J. C. P.

Specific Rotatory Power and Position Isomerism. By Phillipe A. Guye and A. Babel (*Chem. Centr.*, 1899, i, 812, from *Arch. Sci. phys. nat. Genève*, [iv], **7**, 109. Compare preceding abstract). A review of the determinations of the rotation of amylic salts derivatives of tartaric, malic, valeric, and methyladipic acids, menthol, and *d*-carvoxime leads to the following conclusions. If the influence on rotation of mono- and di-derivatives of benzene is compared, the following order is obtained: ortho-compound—phenyl group—meta-compound—para-compound. Following this order, the rotation may steadily increase, decrease, or pass through a maximum or minimum, and these results accord with those obtained by Frankland and Wharton (Trans., 1899, **75**, 337). L. M. J.

Relations between Optical Isomerism and Triboluminescence. By Amerigo Andreocci (*Gazzetta*, 1899, **29**, i, 516—519).—From the results of an examination of santonin derivatives the author draws the following conclusions. 1. Two optical isomerides which are antipodes show the same behaviour as regards triboluminescence. 2. Crystals of racemic forms do not exhibit triboluminescence even though they may be derived from triboluminescent forms. 3. Optically active isomerides which are not antipodes do not behave similarly with respect to triboluminescence. 4. Optically active double forms, resulting from two non-antipodal components, may be triboluminescent.

With these compounds, the triboluminescence diminishes as the crystals are reduced more and more to a fine state of division and also those substances which are strongly triboluminescent possess to a marked degree the properties of superfusion and supersaturation and pass very slowly from the amorphous to the crystalline condition.

T. H. P.

The Latent Photographic Image. By R. Ed. Liesegang (*Chem. Zeit.*, 1899, **23**, 4—5).—Support is given to the view that, on exposure to light, part of the silver bromide becomes transformed into bromine and a lower bromide (argentous bromide, Ag_2Br). On development, this lower bromide becomes completely reduced to metallic silver, and, in order to account for the very large amount of silver thus formed compared with the minute quantities of argentous bromide which can be present on the exposed plate, the following hypothesis is advanced. The silver formed during development from the argentous bromide, is in a "nascent state" and immediately reacts with the argentic bromide, yielding a further quantity of the lower bromide, which, in the presence of the developer, again yields nascent silver. The reaction can thus proceed until the argentic bromide under the exposed parts becomes more or less completely reduced to metallic silver. J. J. S.

Hydrogen Peroxide as the Active Agent in producing Pictures on a Photographic Plate in the Dark. By William J. Russell (*Proc. Roy. Soc.*, 1899, **64**, 409—419).—Hydrogen peroxide acts on a photographic plate in the dark in exactly the same way as certain metals and organic compounds. A photographic plate laid on a dish containing pure water is not affected until a trace of hydrogen peroxide is added, when the plate rapidly darkens. The interposition of substances which are opaque to the action of the metals and terpenes prevents also any action by hydrogen peroxide, whilst the same substances are transparent to the action in both cases. The metals that act most strongly on a photographic plate are those which decompose water most readily; thus the formation of hydrogen peroxide can be accounted for, and even demonstrated, by laying a moistened piece of Wurster's tetramethylparaphenylenediamine paper on the bright metal surface. Practically the terpenes are the only organic compounds which act on a photographic plate, and the oxidation of this class of compounds gives rise to hydrogen peroxide. The ordinary essential and vegetable oils are all more or less active, whilst the mineral oils and compounds like benzene, naphthalene and methylic alcohol produce no effect.

A weak solution of hydrogen peroxide acts on a photographic plate even though gelatin, celluloid, gutta-percha tissue, indiarubber, tracing paper, goldbeater's skin, &c., be interposed, the time required for the action increasing rapidly with the thickness of the intervening layer; the action at first is almost *nil*, and only gradually reaches its maximum effect. When a sheet of the thinnest gelatin was placed over a weak hydrogen peroxide solution, and a plate was laid on the gelatin, successive exposures of twenty minutes each produced photographic impressions of gradually increasing intensity. The hydrogen peroxide requires time to travel through the intervening inactive substance, and the latter may in this way become active and of itself produce an impression on a photographic plate.

The transmission of the action through an inactive substance is greatly assisted by moisture; much less time was required for the production of a picture when the intervening inactive substance was damp. Alcohol also was found to accelerate the transmission of the action.

Several liquids, such as alcohol, ethylic acetate, and chloroform, produced no effect on a photographic plate even after a week's exposure, but when they had been in contact with polished zinc foil, they became active and produced a picture after a short exposure. It was found, however, that the zinc effected this change only when the liquids in question contained a trace of moisture. Perfectly dry specimens remained inactive even after a week's contact with zinc.

The observations show that hydrogen peroxide is the active agent in all the phenomena dealt with. J. C. P.

Electromotive Force of some Concentration Batteries and of a Copper-Zinc Battery with Organic Solvents. By ROBERTO SALVADORI (*Gazzetta*, 1899, **29**, i, 498—500).—A cell consisting of a copper and a zinc plate immersed in a solution of hydrogen chloride or trichloracetic acid in benzene or ether gives no E.M.F., although the zinc is strongly attacked and much hydrogen evolved. The following table gives the E.M.F. obtained on using other solvents :

	Hydrogen chloride.		Trichloracetic acid.	
Solvent.	Concentration.	E.M.F.	Concentration in grams per 100 of solution.	E.M.F.
Water	—	—	6·65	0·830
	N/20	0·838	1·50	0·765
Methylic alcohol	*N*/10	0·633	6·31	0·811
	N/20	0·608	1·12	0·877
Ethylic alcohol	*N*/10	0·537	4·29	0·771
	N/20	0·605	1·07	0·735
Acetone	*N*/10	0·409	5·90	5·573
	N/20	0·410	0·95	0·495 to 0·529*

A table is also given of the E.M.F. of cells containing two zinc rods immersed in different solutions of potassium chloride, the solvents for the latter being water and methylic or ethylic alcohol. In general, the E.M.F. obtained in this way are very small, the largest being with equally concentrated aqueous and ethylic alcoholic solutions of potassium chloride. T. H. P.

Practical Utility of Semi-permeable Membranes. By B. MORITZ (*Chem. Zeit.*, 1899, **23**, 400—401).—Notwithstanding their importance in physico-chemical investigations, semi-permeable membranes have found but little application in practical work. In many cases, however, the author considers they might be usefully employed, and, as examples, suggests the separation, at least qualitatively, of many organic compounds, and the concentration of solutions of unstable compounds. They might also be employed for the determinations of the value of glues and other compounds, which alter on exposure to air, as such alteration would, in all probability, be accompanied by changes in the osmotic pressure. L. M. J.

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* One minute after immersing the electrodes.

Electrolytic Potential. By A. Schükareff (*Zeit. physikal. Chem.*, 1899, **29**, 726—729).—The consideration of the electrolytic properties of solutions may be simplified by the idea of an 'electrolytic potential' which may be defined as the work required to alter the conductivity by unity. On the assumption that the change of electrolytic potential is proportional to the change of chemical potential, the author deduces the equation, $\lambda^2/v = \text{constant}$, for the effect of dilution on conductivity, a result which is valid for very weak electrolytes.
L. M. J.

Electrical Conductivity and Luminosity of Flames containing Vaporised Salts. By Arthur Smithells, H. M. Dawson, and Harold A. Wilson (*Proc. Roy. Soc.*, 1898, **64**, 142—148).—According to Arrhenius, the conduction of an electric current in flames containing vaporised salts is electrolytic in character; the authors' experiments confirm this view, although the electrolytic conduction is different in some respects from that in aqueous solution; Ohm's law, for example, is obeyed only within certain limits.

The conductivity of a vaporised salt increases very rapidly with the temperature. The conductivities of different salts vary with the electropositive constituent, and for various salts of the same metal equivalent solutions sprayed into the flame give equal conductivities, provided the concentration be not too great. The conductivity of the haloid salts as a group is distinct from that of the oxy-salts; the conductivities of the latter are approximately equal, and approach those of the hydroxides. The conductivity of acids is small compared with that of the alkali salts. The introduction of chloroform vapour into a coloured flame and the consequent decolorisation of the flame does not lead to any appreciable decrease of conductivity, so that the colour of a flame produced by a vaporised salt cannot be due, like the conductivity, to the ionisation of the salt; it must be attributed to a chemical process in which the metal is set free, probably to a process of reduction by the flame gases.

The view of Arrhenius that vaporised salts are hydrolysed by the water vapour in the flame, and that the hydroxide then furnishes the ions, is not borne out by experiments made with a cyanogen instead of a coal-gas flame; the presence of water does not seem necessary for the formation of ions. J. C. P.

Electrical Conductivity of Flames containing Salt Vapours. By Harold A. Wilson (*Proc. Roy. Soc.*, 1899, **65**, 120—123. Compare preceding abstract).—When two platinum gauze electrodes are placed in a flame into which a salt solution is sprayed, the current attains a nearly constant value as the E.M.F. increases, provided both electrodes are hot. The current is much greater when the negative electrode is hot and the positive electrode cool, than when the negative electrode is cool and the positive one hot; the fall of potential near a cool electrode is nearly equal to the total fall of potential, especially if that electrode be the negative one.

Nearly all the ionisation of the salt vapour takes place at the surface of the electrodes, and the contact of fresh vapour with the electrodes, especially the negative one, produces a marked increase of current.

The relative velocities of ions in the flame were estimated from the potential fall required to urge the ions against the upward current of gases. In this way, it was found that the positive ions Li, Na, K, Rb, and Cs have nearly the same velocity, whilst the negative ions of various salts of these metals have a velocity about seventeen times as great. The fact that the ionisation of the salts takes place only at the surface of the electrodes, combined with the greater velocity of the negative ions, accounts naturally for the phenomena of unipolar conduction. J. C. P.

Electrolytic Precipitation of Metals on Electrodes of Platinum Gauze. By Clemens Winkler (*Ber.*, 1899, **32**, 2192—2194).—A piece of platinum gauze (weighing 10 grams per sq. cm., containing 250 meshes to the sq. cm., and made of wire 0·12 mm. thick), 10·5 cm. long and 5·5 cm. wide, has its long edges turned over a little, to give it additional strength, a lead of stout platinum wire riveted to it in the centre, and is then bent into a cylinder 5 cm. high and 3·5 cm. in diameter, a slit being left to admit the anode wire. This is used instead of the ordinary cathode of platinum foil; the precipitated metals adhere to it much more firmly than to foil, and the precipitation can be effected with a much greater current-density, and therefore in much less time (as little as one-fourth of the time with a cathode of platinum foil); by its means also, copper may be precipitated, without any tendency to fall off, from a solution acidified with sulphuric acid.

A cathode of brass wire gauze has already been employed by Paweck (*Österreich. Zeit. Berg.-Hüttenwesen*, **46**, 570). C. F. B.

Dissolution of an Iron Anode in a Solution of Sodium Acetate and Acetic Acid. By Georges Arth (*Bull. Soc. Chim.*, 1899, [iii], **21**, 766—768).—When an aqueous solution containing 5 per cent. of sodium acetate and 5 per cent. of acetic acid is electrolysed between a pure iron anode and a platinum cathode, using a feeble current at a low voltage, the iron dissolves as ferrous acetate in an amount corresponding with that required by Faraday's law. At higher voltages, and under certain conditions, which have not yet been accurately determined, the metal assumes an almost "passive" condition, and only a small quantity of ferric acetate is formed. In other experiments, the theoretical amount of iron was dissolved as ferric acetate, a small quantity of ferrous salt being also produced. The work of Wohlwill on univalent and tervalent gold ions is referred to in connection with these results (*Zeit. Elektrochem.*, 1897, **4**, 379, 402, 421). N. L.

[Note by Abstractor.—The similar behaviour of chromium has been noticed by W. Hittorf (compare Abstr., 1898, ii, 363; also *Zeit. Elektrochem.*, 1899, **6**, 6—10).]

Dissociation Equilibrium of Strong Electrolytes. By Hans Euler (*Zeit. physikal. Chem.*, 1899, **29**, 603—612).—Noyes considers the departures from Ostwald's dilution law in the case of strong electrolytes to be due to the fact that determinations of dissociation by the conductivity method are untrustworthy (Abstr., 1893, ii, 1143), whilst Arrhenius regards these as correct, but the mass-action law as inapplicable to such cases. Jahn has pointed out that the dissociation determinations assume the constancy of the ion-velocities at all dilutions (Abstr., 1899, ii, 6); but the author considers that this cannot be the cause of the discrepancies, which frequently occur for dilutions higher than $N/5$, above which the viscosity and the ion-friction are practically constant. Storch has given a general form of dilution law in which the exponent (which in Ostwald's law equals 2, and in Rudolphi's law is 1·5) varies for different salts (Abstr., 1896, ii, 288), and the author has determined this exponent for a large number of salt solutions, for which it varies from 1·4 to 1·7. The values change but slightly with temperature, a small decrease with rise of temperature being observed, so that the discrepancies are not due to polymerisation of the solvent, and the author does not consider the electrostatic attraction of the ions to be a possible cause. The most probable cause is finally considered to be an alteration of the dissociative power of the solvent, consequent on the presence of the dissolved salt (compare Abstr., 1899, ii, 492). L. M. J.

Alteration of Free Energy in Melted Halogen Compounds of some Metals. By Oskar H. Weber (*Zeit. anorg. Chem.*, 1899, **21**, 305—360).—This work, which necessitates the determination of the E.M.F. of cells with molten salts, is essentially similar to that of Czepinski (this vol., ii, 267), but the determinations have been carried to higher temperatures and with improved apparatus. The E.M.F. of the chain $Pb \mid PbCl_2 \mid Cl$ was determined between 502° and 956°, the latter being the boiling point of the salt. It was found that the temperature coefficient was practically constant from the melting point (506°) to about 900°, so that between these limits the alteration of total energy, that is, the heat development, is practically constant (*loc. cit.*), and, further, that the heat capacity of the compound is equal to the sum of the heat capacities of the components. By subtraction of the external work, the heat development is obtained which should be directly comparable with that determined directly, the differences are very slight and do not reach 0·5 per cent. From the heat produced above and below the melting point, the value 5·607 Cal. is obtained for the latent heat of fusion of lead chloride, a number in accord with Rudberg's direct determination, 5·806 Cal. Czepinski found that above 650° a very rapid fall of E.M.F. occurs, and this is due to the backward diffusion of the lead and chlorine; in the author's experiments, this does not occur until about 900°, owing to the improved form of the electrolytic tube. With lead bromide, analogous results were obtained, but the agreement with thermochemical determinations is not so satisfactory. The melting and boiling points were found to be 490° and 918° respectively, and the latent heat of fusion 5·1 Cal. (direct determinations = 4·5 Cal.). Similar chains, with silver chloride and silver bromide, were examined; in the latter case, two sets of values were obtained, abnormal results being found for two or three readings, but as the E.M.F. again became normal, this appeared to be due to the action of the molten salt on the porcelain. The latent heat of fusion of silver chloride was calculated to be about 4·4 Cal. The chain with cadmium chloride is interesting, as at the higher temperatures both cadmium and chlorine are gaseous; the melting and boiling points of the salt were found to be about 568° and 964° respectively, and the boiling point of cadmium about 780°. The value for the latent heat of fusion of the salt is 10·5 Cal., a number which is apparently high; the latent heat of vaporisation of cadmium is 26 Cal., and this is probably very nearly correct. Cadmium bromide was examined to 860°, and the latent heat of fusion found to be 5·0 Cal. The following are the values of the E.M.F.'s found for these chains: $Pb \mid PbCl_2 \mid Cl$, $1{\cdot}2818 - 0{\cdot}0_3584\,(t - 506)$; $Pb \mid PbBr_2 \mid Br$, $1{\cdot}0571 - 0{\cdot}0_3500\,(t - 490)$; $Ag \mid AgCl \mid Cl$, $0{\cdot}8848 - 0{\cdot}0_3270\,(t - 650)$; $Cd \mid CdCl_2 \mid Cl_2$, $1{\cdot}3680 - 0{\cdot}0_3580\,(t - 590)$, $Cd \mid CdBr_2 \mid Br$, $1{\cdot}1319 - 0{\cdot}0_3486\,(t - 610)$, the cadmium values being only for temperatures below 780°. Chains of the Daniell type were also examined with lead and silver electrodes at temperatures from 500° to 1000°; the values agree fairly with those calculated from the previous chains, and indicate for both metals a greater dissociation in the chloride than in the bromide.

L. M. J.

Ratio of the Specific Heats in some Gaseous Saturated Hydrocarbons. By A. Daniel and Paul Pierron (*Bull. Soc. Chim.*, 1899, [iii], **21**, 801).—Determinations by Kundt's method of the ratio of the two specific heats for ethane (1·225), propane (1·153), and isobutane (1·108) gave the values indicated. In the case of ethane, Clément and Desormes' method was also employed, the value 1·213 being obtained.

N. L.

Specific Heats of Gases and Mechanical Equivalent of Heat. By Anatole Leduc (*Ann. Chim. Phys.*, 1899, [vii], **17**, 484—510).—A thermodynamical paper not suitable for abstraction.

G. T. M.

Acoustical Method for the Determination of the Melting Point of Fats and Waxes. By Edwin Dowzard (*Chem. News*, 1899, **79**, 150—151).—The author employs two platinum wires connected with a battery and an electric bell; the wires are coated with the fat or wax, then immersed together in mercury, which is gradually heated; when the fat melts, the circuit closes, the bell then rings, and the temperature is read.

D. A. L.

Melting Points of Mixtures of Optical Isomerides. By M. Centnerszwer (*Zeit. physikal. Chem.*, 1899, **29**, 715—725).—The melting point curves for various mixtures were first determined in the case of two indifferent compounds, and found to consist of two portions with a minimum. The curves of two active optical isomerides are completely symmetrical with two minima and a maximum at the melting point of the inactive compound, which may, however, be either higher or lower than that of the active components. The addition of either active component to the inactive compound, or the reverse, causes a depression of the melting point, but apparent exceptions occur in the cases of dimethylic tartrate and tartaric acid. The first of these is probably due to the minima being too near the axis of coordinates, and the second to homogeneous crystallisation (compare Küster, Abstr., 1892, 396). In general, the results are in complete accord with the statements of Roozeboom (this vol., ii, 355). L. M. J.

Vapour Pressure Measurements. By ULRICH DÜHRING (*Zeit. physikal. Chem.*, 1899, **29**, 730—731).—A reply to observations made by Kahlbaum in his paper on this subject (Abstr., 1898, ii, 556).
L. M. J.

Direct Determination of Heats of Combination of Halogen Compounds: Aluminium Bromide. By NICOLAI N. BÉKÉTOFF (*Chem. Centr.*, 1899, i, 1062; from *Bull. Acad. St. Pétersbourg*, [v], **10**, 79—81).—The heat of combination of aluminium and bromine to form Al_2Br_6, has been directly determined, and found to be 41,000 cal. per atom of bromine. Thomsen and Berthelot's indirect determinations gave 40,000 and 42,000 cal. respectively. E. W. W.

Thermochemical Measurements. By MARCELLIN P. E. BERTHELOT (*Compt. rend.*, 1899, **129**, 320—321).—The results are summarised in the following table:

	Heat of combustion.			Heat of formation from elements.	Heat of dissolution at about 25°.
	1 gram. cal.	1 mol. at const. v. Cal.	1 mol. at const. p. Cal.	Cal.	Cal.
Cholic acid	7985	3401·7	3406·1	306·35	—
Amygdalin	5139·6	2348·7	2349·2	468·5	—
Conicine	10027·7	1273·5	1275·5	65·4	+5·1
Ethylenediamine......	—	—	—	8·8	+7·45
Ethylenediamine hydrate	—	—	—	80·6	+4·68
Ethylenediamine dihydrochloride ...	—	—	—	124·5	+6·65

The formation of cholic acid from cholesterol by oxidation would correspond with a considerable development of heat. The hydrolysis of amygdalin is accompanied by very little thermal disturbance.

The heat of neutralisation of conicine by hydrochloric acid is 11·4 Cal. The heat of dissolution of conicine hydrochloride obtained from Kahlbaum was −0·87 Cal., whilst the same compound prepared from Merck's conicine gave −1·49 Cal. Probably they were salts of isomeric conicines. The heat of formation of conicine hydrochloride is lower than that of ammonium chloride, but higher than that of aniline hydrochloride. The difference between the heats of formation of conicine and piperidine (40·9 Cal.) is much higher than would be the case if they were normal homologues (17 Cal.).

The heat of hydration of ethylenediamine is +2·77 Cal., and does not differ greatly from the heat of combination of liquid ammonia and water, +3·11 Cal. Its heat of neutralisation is +12·4 for the first equivalent and +10·8 for the second. The heat of formation of the solid dihydrochloride from the liquid base and the gaseous acid is +70·9 Cal. In the activity of its basic function, ethylenediamine hydrate is comparable with ammonium and potassium hydroxides. C. H. B.

Thermochemistry of Salicylaldehyde, Parahydroxybenzaldehyde, and Salicylhydramide. By MARCEL DELÉPINE and PAUL RIVALS (*Compt. rend.*, 1899, **129**, 520—523).—The authors have redetermined the thermochemical constants of salicylic acid and some of its derivatives, there being discrepancies between the recorded results of different observers.

Salicylic acid.—Molecular heat of combustion at const. vol. and const. pressure, 728·2 Cal., the mean of this and Stohmann's values being 728·3 Cal. Heat of formation from elements +138·8 Cal.; from solid phenol and carbonic anhydride +7·7 Cal., which differs from Berthelot and Werner's direct determination (+6·3 Cal.).

Salicylaldehyde.—Heat of combustion, 1 gram, +6527·4 cal.; molecular heat of combustion, 796·34 Cal. at const. vol., and 796·6 Cal. at const. pressure; heat of formation from elements, +70·5 Cal.; heat of oxidation to salicylic acid, +68·3 Cal.

Parahydroxybenzaldehyde.—The corresponding values are 6500·6 cal., 793·07 Cal., 793·3 Cal., +73·8 Cal. and +67·4 Cal.

In both cases, the heat of oxidation approximates to that of benzaldehyde, anisaldehyde, and cinnamaldehyde.

Salicylhydramide, contrary to the statements of previous observers, always melts at 167°, by whatever method it may be prepared, and, contrary to the statement of Ettling, is rapidly decomposed by acids and alkalis at the ordinary temperature. Heat of combustion (1 gram), 7305·6 cal.; molecular heat of combustion, 2527·73 Cal. at const. vol., and 2528·9 Cal. at const. pressure; heat of formation from elements, +72·4 Cal., and from ammonia and salicylaldehyde $2 \times 12·95$ Cal. The action of potassium hydroxide on the hydramide takes place in two stages, the first development of heat, 3·1 Cal., corresponding with the saturation of the third phenolic function of the hydramide. This indicates that two of the phenolic functions have been saturated by the nitrogen, which becomes quinquevalent, and this in its turn explains why salicylhydramide is yellow and not white, like most hydramides.

Parahydroxybenzaldehyde does not yield a corresponding hydramide. C. H. B.

Heat of Neutralisation and Electrolytic Dissociation. By WILHELM VAUBEL (*Chem. Zeit.*, 1899, **23**, 764—765).—The author attempts to explain the constant value of 137—138 *k* [*k* = 100 cal.] for the heat of neutralisation of strong bases and acids. His method of calculation of the molecular association (Abstr., 1898, ii, 593) indicates that in liquid water the molecule consists of 6 simple molecules and the heat of association is 726 *k*. The solution of base and acid and the subsequent neutralisation are then represented, thus: (i) $MOH + 6(H_2O) = M,H_2O + OH,5H_2O$; (ii) $A,H + 6(H_2O) = A,5H_2O + H,H_2O$; (iii) $OH,5H_2O + H,H_2O = (H_2O)_6 = \frac{1}{6}(H_2O)_6$; the heat development for this latter equation is calculated to be 142·4 *k*, a number not far removed from the experimental values. The author considers that the electric charges of the hydroxyl and hydrogen ions must pass over to the metallic and acid ion during neutralisation, and that this explains the higher E.M.F. necessary for the decomposition of the salt. He further attempts to show that his thermal values also explain the value of 0·59 volt which Glaser found for the decomposition potential of the hydroxyl ions (this vol., ii, 79). L. M. J.

Thermal Effects of the Dilution of certain Salts. By FRANCIS P. DUNNINGTON and T. HOGGARD (*Amer. Chem. J.*, 1899, **22**, 207—211).—The authors give a table showing the thermal effect of adding successive gram-molecules of water to nearly saturated solutions of ammonium acetate, lithium chloride, sodium bromide, magnesium nitrate, and calcium, magnesium and strontium chlorides; in all these cases, heat is developed on dilution, and it appears that by far the greater part of the thermal change occurs during the addition of the first few molecules of water. In the case of solutions of ammonium and sodium nitrates, ammonium, sodium and potassium chlorides, and potassium bromide and iodide, the same is true, but the dilution is endothermic; a solution of calcium nitrate, however, on dilution, at first gives out heat, but subsequently absorbs it. W. A. D.

Cryoscopic Measurements. By A. PONSOT (*Bull. Soc. Chim.*, 1899, [iii], **21**, 764—765).—A former paper by the author (this vol., ii, 546) requires sundry corrections, which do not, however, invalidate the conclusions arrived at therein. N. L.

Cryoscopic Depression in, and Latent Heat of Fusion of, Naphthylamine and Diphenylamine. By JOHN MASON STILLMANN and R. E. SWAIN (*Zeit. physikal. Chem.*, 1899, **29**, 705—710).—The molecular cryoscopic depressions for solutions in diphenylamine and in naphthylamine do not agree with those calculated by the van't Hoff expression $0·0199\ T^2/w$. The authors have therefore redetermined the cryoscopic depressions and the latent heats of fusion, as well as incidentally the specific heats of solid and liquid, in the case of pure specimens of the two compounds, a form of calorimeter designed by Waterman being employed. The cryoscopic determinations agreed completely with those of Eijkman, and the other values were diphenylamine, m. p. 54·0°, latent heat of fusion, 23·97; naphthylamine, m. p. 50·1°, latent heat of fusion, 25·59. The cryoscopic constants calculated from these numbers are 81·2 for naphthylamine and 88·8 for diphenylamine, agreeing well with the experimentally determined values 78 and 88 (Abstr., 1889, 666). L. M. J.

Method for Vapour Density Determination. By LUDWIG WILHELM WINKLER (*Chem. Zeit.*, 1899, **23**, 627).—The method is similar to that of Dumas; the apparatus consists of a thin-walled glass bulb of about 100 c.c. capacity, drawn out to a long, narrow neck which can be closed by a ground stopper. The bath is a modified

V. Meyer constant temperature bath, and the glass bulb does not come in contact with the boiling liquid. The bulb, full of air, is heated for 10 minutes in the bath, the stopper (slightly greased) inserted, and the whole weighed when cold; the operation is then repeated with the gas or vapour whose density is required. J. J. S.

Change of Volume at the Transition Point of Boracite. By Wilhelm Meyerhoffer (*Zeit. physikal. Chem.*, 1899, **29**, 661—664).—At a temperature of from 260° to 270°, boracite undergoes a transition from the rhombic to the regular system, and the author, employing the dilatometric method, shows that this transition occurs at 266° and is accompanied by a decrease in volume. L. M. J.

Application of Molecular Volumes. By Anatole Leduc (*Ann. Chim. Phys.*, 1899, [vii], **17**, 173—196).—The paper contains several tables showing the differences between the specific volumes of isopentane, ether, carbon bisulphide, and water vapours obtained by direct experiment and those calculated by the author from critical constants. The experimental data bearing on the dissociation of chlorine, nitric peroxide, and acetic acid vapour, are also discussed (compare Abstr., 1898, ii, 471, and this vol., ii, 354).

The atomic weight of hydrogen obtained by the author's calculations is 1·0076 ($O = 16$) and agrees closely with the value deduced from Sacerdote and Berthelot's experiments (this vol., ii, 404). G. T. M.

Dissociation of Nitric Peroxide. By A. Pochettino (*Real. Accad. dei Lincei,* 1899, **8**, 183—188).—A series of 29 measurements was made of the wave-length of sound in nitric peroxide at temperatures ranging between 4·2° and 150°, Kundt's formula being employed in calculating the results. The density of the gas at each temperature was taken from the tables of Natanson and of Troost and Deville, intermediate values being obtained by means of Gibbs' formula for the density of a dissociated gas. From the numbers thus found, the corresponding values k of the ratio of the specific heats have been calculated; the values of k have also been deduced from the law of mixtures, the gas being taken as a mixture of N_2O_4 and NO_2 in proportions given by its density. k is found to increase regularly with the temperature from 1·17 to 1·30, these values corresponding respectively with the hexatomic molecule N_2O_4 and the triatomic molecule NO_2; the agreement between the two sets of values is satisfactory. T. H. P.

Theory of Diffusion. By Emil Bose (*Zeit. physikal. Chem.*, 1899, **29**, 658—660).—From the equation for the diffusion of a non-electrolyte, that for the diffusion of a completely dissociated compound as deduced by Nernst, and the equilibrium equation $kc = (A - c)^2$, the author deduces expressions available for the diffusion of partially dissociated electrolytes, for which, however, no experimental support is offered although they are capable of such verification. L. M. J.

Diffusion of Ions into Gases. By John S. Townsend (*Proc. Roy. Soc.*, 1899, **65**, 192—196).—A gas which has been ionised by the action of Röntgen rays gradually loses its conductivity if left to itself;

the ions partly recombine and partly give up their charges to the walls of the containing vessel. If a stream of an ionised gas be passed through a metal tube of small bore, the loss of conductivity due to recombination of the ions will be negligible compared with that due to the absorption of the ionic charges by the metal tube. This latter will depend on the diffusion of the ions, and a mathematical discussion shows how the coefficient of diffusion may be calculated from the reduction of conductivity. With the help of the values obtained, it is shown that the ionic charges produced by Röntgen rays in air, oxygen, carbonic anhydride, and hydrogen are all the same and equal to the charge on a hydrogen ion in a liquid electrolyte. The number of molecules in 1 c.c. of a gas is estimated as 2×10^{-19}, and the weight of a molecule of hydrogen is calculated to be $4{\cdot}5 \times 10^{-24}$ grams. J. C. P.

A Hydrate Theory of Solution. By **Flavian Flawitzky** (*Chem. Centr.*, 1898, i, 651—653; from *J. Russ. Chem. Soc.*, **29**, 565—583).—A mathematical discussion leads the author to the conclusion that the same law applies to electrolytes as to non-electrolytes. Two types of solutions are distinguished: (1) normal solutions, in which the existence of normal hydrates can be demonstrated; (2) abnormal solutions, which give no indication of the formation of normal hydrates. The difference in the two cases depends only on the relative stability of the hydrates.

The extent of hydration in solution is directly proportional to the molecular weight; the same holds for cryohydrates, and the author therefore believes that the latter have an important influence on the properties of aqueous solutions. J. C. P.

Laws of Solutions. By **Wladimir A. Kistiakowski** (*Chem. Centr.*, 1899, i, 89—91; from *J. Russ. Chem. Soc.*, 1898, **30**, 576—585).—Apparatus is described in which osmotic pressure in gases may be observed and determined, the method depending on the fact that many membranes, &c., are permeable to some gases but not to others. Argon is found to diffuse through caoutchouc 100 times as rapidly as carbonic anhydride, and by means of a caoutchouc membrane separating air and ether vapour a rise in pressure of 15 cm. of mercury was observed. The laws of osmotic pressure are calculated from the basis of the law that in a system in equilibrium a small disturbance is not associated with any energy change, hence if a gas be in equilibrium with a solution $pdv - qdv_1 = 0$, where p is the partial pressure of the gas, q its osmotic pressure, and dv and dv_1 the respective volumes in the gaseous state and in the solution, and hence, since dv/dv_1 is constant $qv_1 = RT$. The author also shows that in the calculation of the cryoscopic depression a term involving the heat of dilution is necessary, the expression obtained being $T - T_1 = T/Q(RT/1000V_1 + Z)$ where Z is the heat liberated when 1 gram of the solvent is withdrawn from the quantity of solution which contains 1 gram-molecule of the solute. Comparison with the depression obtained in hydrogen chloride solutions shows that when this correction is applied the calculated values agree well with determinations for cryoscopic depressions as high as 28·8°. L. M. J.

Solid Solutions and Isomorphous Mixtures of Saturated and Non-saturated Open-chain Compounds. I. and II. By Giuseppe Bruni and F. Gorni (*Real. Accad. dei Lincei*, 1899, [v], 8, 454—463, and 570—579. Compare Abstr., 1898, ii, 562).—In ethylenic bromide solution, ethylenic chlorobromide has the molecular weight 343—359, the normal value being 143·5, and in the same solvent, ethylenic cyanide gives the values 98—135, the number corresponding with the formula being 80.

Dissolved in dimethylic succinate, dimethylic maleate shows normal, and dimethylic fumarate abnormal, cryoscopic behaviour; in the latter case, the molecular weights found are 797 to 914 instead of 144. As regards crystalline form and configuration, fumaric and succinic acids are closely related, whilst maleic acid has no such similarity with succinic acid.

Using butyric acid as solvent, the cryoscopic behaviour of crotonic acid, is abnormal and that of isocrotonic acid normal. Since crotonic acid melts at a higher temperature than the corresponding saturated acid and further is more stable than the iso-acid, the fumaroid formula must be assigned to it and to isocrotonic acid the corresponding maleoid formula.

In phenylpropionic acid solution, cinnamic acid raises the point of solidification, whilst allocinnamic acid gives the normal depression. Cinnamic acid has therefore a fumaroid molecular configuration, allocinnamic acid being the corresponding maleoid form.

Cryoscopic determinations of the molecular weight of elaidic acid in stearic acid solution give the value 303—315 instead of the normal number 282; also, stearic acid dissolved in elaidic acid has the molecular weight 348—370, whilst the formula corresponds with the number 284. These abnormal values show that stearic acid and elaidic acid form solid solutions, and to the latter must be attributed a fumaroid configuration, the isomeric oleic acid being the corresponding maleoid compound (Garelli and Montanari, Abstr., 1895, ii, 205). These conclusions are borne out by the greater stability towards reagents, and the higher melting point, of elaidic acid.

Muthmann (Abstr., 1898, i, 614) has shown that if the CH_2-group of potassium or ammonium methanedisulphonate be replaced by NH, the imidosulphonates thus obtained are isomorphous with the corresponding methanedisulphonates. This equivalence of CH_2 and NH does not obtain in the case of some other compounds. Thus diphenylamine shows normal cryoscopic behaviour in diphenylmethane solution. But benzylideneaniline and stilbene both have abnormal molecular weights in azobenzene solution; the isomorphism of stilbene and azobenzene thus indicated is confirmed by crystallographic measurement. Both crystallise in the monoclinic system. For azobenzene, [$a:b:c = 2\cdot10756:1:1\cdot33123$ and $\beta = 65° 34'$], whilst for stilbene, [$a:b:c = 2\cdot17015:1:1\cdot40033$ and $\beta = 65° 54'$]. Hydrazobenzene, benzylaniline, and dibenzyl all show abnormal cryoscopic behaviour in azobenzene. Dibenzyl is also crystallographically completely isomorphous with azobenzene and stilbene, and the last raises the melting point of dibenzyl.

The following conclusions are drawn. 1. The groupings -CH=CH- of a fumaroid compound and $-CH_2-CH_2-$ are isomorphotropic with -N=N-. 2. By substituting -N=CH- for one of the preceding groupings, the compounds retain morphotropic relations and are capable of forming solid solutions. 3. The substitution of -NH-NH- removes all similarity of configuration and hence also the capacity of forming solid solutions. 4. The effect of substituting the grouping $-CH_2-NH-$ is not well defined.

T. H. P.

Cryoscopic Behaviour of Substances with Constitutions similar to that of the Solvent. IV. By FELICE GARELLI and F. CALZOLARI (*Real. Accad. dei Lincei*, 1899, [v], **8**, 579—590; *Gazzetta*, **29**, ii, 258—284. Compare preceding abstract).—When dissolved in thymol, menthol forms solid solutions with it, the molecular weight obtained being 168—177, instead of 156.

The freezing points of mixtures of dibenzyl and stilbene show very considerable differences from the values calculated by means of Küster's law for isomorphous mixtures, the largest difference being 17·36° for a mixture containing 40·66 per cent. of dibenzyl.

In dibenzyl solution, hydrazobenzene gives normal depression of freezing point, whilst azobenzene, benzylideneaniline, and benzylaniline behave abnormally.

Of the two theoretically possible stilbenes, that known must be regarded as the fumaroid modification.

Dibenzyl, stilbene, azobenzene, and benzylideneaniline all behave abnormally in benzylaniline solution, as does triphenylamine in triphenylmethane solution. T. H. P.

Cryohydric Phenomena in Solutions of Enantiomorphous Isomerides. By GIUSEPPE BRUNI (*Real. Accad. dei Lincei*, 1899, [v], **8**, 332—335).—The method employed by Roozeboom (this vol., ii, 276) for distinguishing between racemic compounds, inactive conglomerates, and pseudo-racemic mixtures by means either of the melting point curve or of the solubility curve of the solid, has a complete analogue in the method suggested by the author, who makes use of the curve of saturation in the case of binary mixtures, and of the cryohydric curve in the case of ternary mixtures. By this means are avoided the disadvantages of Roozeboom's method, which requires relatively large quantities of material, is not applicable to substances decomposing before melting, and, if the solubility curve be employed, involves experimental difficulties. T. H. P.

Recognition of Racemic Compounds. By H. W. BAKHUIS ROOZEBOOM (*Ber.*, 1899, **32**, 2172—2177. Compare this vol., ii, 276 and 401; also following abstract).—The author considers that Ladenburg's statements (Trans., 1899, **75**, 465; this vol., ii, 551) are less complete than his own (*loc. cit.*), and, as regards some of them, not accurately formulated. He also points out that Ladenburg, in applying to liquid externally compensated compounds the method used in the case of solids, has paid no attention to the phase rule, and hence his conclusions are invalid; in fact, determinations of solubility are not suitable for determining whether a liquid is a racemic compound or an inactive conglomerate. J. J. S.

Recognition of Racemic Compounds. By FREDERIC STANLEY KIPPING and WILLIAM J. POPE (*Ber.*, 1899, **32**, 2225—2227. Compare Trans., 1899, **75**, 36, and preceding abstract).—It is pointed out that Ladenburg's modified method (Trans., 1899, **75**, 465) is essentially different from his original one (*Ber.*, 1894, **27**, 3065) and that it is now in accordance with the results described by the authors (*loc. cit.*). The conclusions arrived at by Ladenburg with respect to the racemic nature of liquids such as *i*-pipecoline are invalid, as he has completely neglected the application of the phase rule. J. J. S.

New Method for the Resolution of Racemic Compounds into the Active Constituents. By WILHELM MARCKWALD and ALEX. MCKENZIE (*Ber.*, 1899, **32**, 2130—2136).—*r*-Mandelic acid has been etherified by the aid of an optically active alcohol, namely, *l*-menthol, and the results indicate that *l*-mandelic acid is not quite so readily etherified as the *d*-acid. The method, however, does not lend itself, at any rate in this case, to the complete resolution of the racemic acid, since after 50 grams of the acid and alcohol had been heated at 155° for 1 hour, only about 0·72 gram of the *l*-acid could be isolated. The menthylic mandelate formed in the reaction, when fractionally hydrolysed, gave first an acid having a slightly positive rotation (but the actual isolation of the *d*-acid was not attempted), and finally an acid with a negative rotation. Although the method is not so efficient as other methods for the resolution of racemic acids, the authors conclude that it may be of practical use for the resolution of racemic alcohols by the aid of an optically active acid. J. J. S.

Hylotropic-isomeric Forms. By KARL SCHAUM (*Annalen*, 1899, **308**, 18—40. Compare Abstr., 1898, ii, 211 and 372).—The cases of sulphur, tin, hexachloroketodihydrobenzene, nitrosobenzene, and menthol are discussed by the author. M. O. F.

Gaseous Reactions in Chemical Kinetics. V. Gradual Combination of Oxyhydrogen Gas. By MAX BODENSTEIN (*Zeit. physikal. Chem.*, 1899, **29**, 665—699).—The present paper deals with the non-explosive combination of hydrogen and oxygen when the mixture is passed through porcelain tubes raised to the desired temperature by means of a lead-bath. From the total volume of gas passed through, and the total time, the time during which the gas was exposed to the high temperature is found, and by varying these values various determinations of the velocity constant were made at temperatures of 482°, 509°, 560°, and 572°. The values at each temperature, as calculated for a trimolecular equation, are constant, and equal values were obtained on varying the initial proportions of the two gases; the action hence proceeds according to the equation $2H_2 + O_2 = 2H_2O$. The actual values of the constant vary with the form of the tube employed, and the author finds that the ratio of the constants for two tubes is approximately equal to the ratio of the quotients surface/volume, and hence concludes that the action proceeds almost entirely on the surface of the vessel and not throughout the entire mass, that is, it is a catalytic action. At temperatures which vary from 660° to 700° for different tubes, the steady union becomes explosive, and as the explosion temperature is approached, the velocity constant, previously in accord with that given by equation $\log k = A/T + B \log T + c$, increases enormously above the calculated values. The author considers this to be due to the imperfect conduction of heat, so that the heat generated by the union raises the temperature of the gas above that of the surroundings, and the explosion temperature is hence highest for vessels of greatest comparative surface. The results of the author are not in accord with those previously obtained by Hélier (this vol., ii, 85). L. M. J.

Velocity of Explosion of Acetylene. By Marcellin P. E. Berthelot and Henri Le Chatelier (*Compt. rend.*, 1899, **129**, 427—434. Compare Abstr., 1897, ii, 91).—The velocity of explosion of pure (98 per cent.) acetylene was studied at pressures varying from 5 to 36 kilograms per square centimetre, the gas being enclosed in glass tubes 1 metre in length and having an internal diameter of 2—6 millimetres. One end of the glass tube was closed, and the other end connected with an iron vessel in which the explosion was started by firing electrically a detonator of fulminate or chlorate mixture weighing 0·01—0·04 gram. Larger amounts are to be avoided, since they give rise to violent undulatory movements which are not strictly due to the detonation itself. In some cases, the influence of any irregular initial disturbance was obviated by introducing an iron tube, 1·5 metres in length, between the glass tube and the iron vessel. The phenomena observed in the glass tube were registered on a photographic plate which was made to drop in a frame at the moment of firing, so that the image of the flame traversing the tube was recorded in the form of a curve, the inclination of the tangent at any point of the latter being a measure of the velocity at which the explosion is being propagated at the corresponding part of the tube. The results of a number of experiments show that, contrary to what is observed with mixtures of acetylene and oxygen, the velocity of explosion of pure acetylene increases continuously with the propagation of the flame along the tube, which is generally ruptured before a uniform velocity can be attained. The fracture, or rather pulverisation, of the tube takes place, as a rule, when about half its length has been traversed, and is propagated backwards with a velocity comparable with that of the explosion. In the greater number of cases, the curve obtained assumes almost immediately an asymptotic form, indicating that the velocity, after a certain point, increases but slowly until, at the moment of rupture, a large and abrupt increase is noticed. In a considerable number of experiments, however, a more continuous and rapid increase was observed. These different results are independent of the pressure and appear to be connected with differences in the manner in which the explosion is initiated. According to the most uniform and regular determinations, the velocity of explosion increases with the pressure from 1000 metres per second at 5 kilograms per square centimetre to about 1600 metres at 30 kilograms.

The theoretical signification of the results obtained is finally discussed, and it is pointed out that a fundamental distinction exists between waves, such as those of sound, which are propagated from a single, unrenewed impulse and those occurring in an explosive mixture or an endothermic gas in which a continually increasing amount of energy is set free. The explosive properties of acetylene may be expected to differ from those of combustible gaseous mixtures, since the products of its decomposition, gaseous hydrogen and solid carbon, have very different physical properties. Moreover, in the combustion of hydrogen and gaseous hydrocarbons with oxygen, the carbonic anhydride and water formed, which are partially dissociated at the temperature of explosion, undergo association as the temperature falls and thus modify the violence of the initial shock, whereas acetylene is abruptly resolved into free carbon and hydrogen. N. L.

Velocity Constants in the Formation of Simple Ethers. By W. Sagrebin (*Chem. Centr.*, 1899, i, 1059—1060; from *J. Russ. Chem. Soc.*, 1899, **31**, 19—27).—The velocity constants were determined at 100° for the reaction between alcohols and ethereal salts of benzenesulphonic acid with the production of the ether and acid. Excess of the alcohol was employed as a solvent, and on this account the reaction is of the first order. The values for the constant compared with that for methylic alcohol are as follows: methylic alcohol, 100; ethylic alcohol, 48·9; propylic alcohol, 35·2; isobutylic alcohol, 21·4; *i*-isoamylic alcohol, 23·6; octylic alcohol, 16·2; allylic alcohol, 28·1; benzylic alcohol, 14·98. The order, which shows the influence of constitution, is the same as that obtained by Menschutkin for the rate of etherification of alcohols and the velocity of reaction of amines with allylic bromide, although differences occur in the actual numbers, explicable by the use of different solvents (Abstr., 1890, 1366; 1898, i, 119). Values for isopropylic alcohol, 16·1, and phenylmethylcarbinol, 4·5, were also obtained, but with trimethylcarbinol and dimethylethylcarbinol, constant values for the velocity constant were not observed. L. M. J.

Function of the Medium in Chemical Change. By Julius W. Brühl (*Ber.*, 1899, **32**, 2326—2331.) [Compare Lowry, Trans., 1899, **75**, 215—228].—The velocity of isodynamic change has been studied by means of the refractive and dispersive powers in the case of the enolic and ketonic forms of Claisen's ethylic mesityloxidoxalate (Abstr., 1896, i, 561), dissolved in different media; the refractive powers of the two isomerides are very different, and the dispersive powers differ by 400 per cent.

No isomeric change takes place on dissolving the enolic form, or on diluting the solution, the small changes in the optical constants being due to physical and not to chemical causes. Of the solvents used, chloroform produced the least acceleration, and in this solvent the formation of the ketonic form is hardly perceptible after 2½ months; benzene, *α*-bromonaphthalene, and carbon bisulphide act somewhat more rapidly, but the greater part of the enolic form is unchanged after 3 months; methylic and ethylic alcohol, on the other hand, cause a marked change in a few days, and in 2 or 3 months nearly the whole of the enolic is converted into the ketonic form, the reaction being complete and not proceeding to a state of equilibrium. The isomeric change is regarded as due to the ionic dissociation of the enolic form, followed by a reassociation of the ions in the ketonic form, and it is pointed out that the isomeric change takes place most rapidly in those media which have the greatest dissociating and dielectric power; these media are also usually characterised by great heat of vaporisation, heat of fusion, and specific heat.

T. M. L.

[Dissociation of Molecular Chlorine by Water.] By ALEXANDER A. JAKOWKIN (*Zeit. physikal. Chem.*, 1899, **29**, 613—657).—The author has previously shown that in a solution of chlorine in water equilibrium is finally attained when $Cl_2 + Aq \rightleftarrows \overset{-}{Cl} + \overset{+}{H} + HClO + Aq$ (Abstr., 1897, ii, 246), and has now further investigated this equilibrium. As hypochlorous acid is a very weak electrolyte, the conductivity of chlorine solutions is almost entirely due to the hydrogen chloride, and the concentration of the latter can therefore be determined from conductivity experiments. By subtraction of double the quantity of chlorine so found from the total chlorine, the concentration of undissociated molecules is obtained, and it is found that when the concentration is so calculated, the partition ratio of chlorine between carbon tetrachloride and water is constant for all concentrations, so that the quantity of undissociated chlorine in water may be calculated from that in carbon tetrachloride in equilibrium with the solution. The gas is also shown to be present in both solvents in the form of simple molecules. The hydrolysis in water at various concentrations was then determined and the values of the equilibrium constant were found to remain constant when calculated for the trimolecular equation $k.c = (A - c)^3$. If chlorine ions be added, the dissociation of molecular chlorine must decrease, and, by addition of chlorides, this was found to be the case, the equilibrium constant for $kc = (A - c)^2(A - c + b)$ being equal to that previously obtained. In strong solutions, apparent variations occur consequent on the alteration of the partition ratio. Undissociated chlorides should produce no effect, but it was found that mercuric chloride causes a slight increase of dissociation which is explicable by the union of the salt with some hydrogen chloride (Le Blanc and Noyes, Abstr., 1891, 388). The effect of hydrogen ions, which should be equal to that of chlorine ions, was found to be in entire accord with theory, the acids employed being dilute sulphuric, nitric, acetic, and the three chloracetic acids. Boric acid, which is practically undissociated, has no effect except in strong solutions. Hydrochloric acid yields both hydrogen and chlorine ions and its effect is therefore considerably greater than that of other acids, the dissociation being in this case given by $kc = (A - c)(A - c + b)^2$. In solutions of hydrochloric acid, therefore, of moderate strength, the dissociation of the chlorine is very slight; for high concentrations, however, the results are complicated, owing to the formation of the trichloride HCl_3. The agreement of all the determinations with those calculated by the trimolecular equation is well seen by comparison of the experimental values with the theoretical curves, and conclusively proves the dissociation. The latter may also be calculated entirely from conductivity observations, and the results so obtained agree completely with the former determinations. The equilibrium constant increases with rise of temperature, so that the hydrolysis is accompanied by heat absorption, which decreases from about 7 Cal. at ordinary temperature to zero at from 75° to 95°, and the heat of solution of undissociated chlorine may also be calculated. The results are in accord with the determinations of Thomsen, and with the values for the hydrolysis calculated from the heats of formation of hydrochloric and hypochlorous acids.

L. M. J.

Equilibrium between Hydrocyanic and other Acids in Combination with Alkalis. By MARCELLIN P. E. BERTHELOT (*Ann. Chim. Phys.*, 1899, [vii], **17**, 453—457).—Potassium cyanide is completely decomposed by hydrochloric acid; when solutions containing each of these reagents are mixed at 15°, the heat developed is 10·7 Cal.; the same value is obtained for nitric acid, whilst 10·3 Cal. are developed in the case of acetic acid; these figures coincide with the theoretical values.

When solutions containing phenol (1 mol. in 20 litres) and potassium cyanide (1 mol. in 2 litres) are mixed together, 5·2 Cal. are developed. The hydrocyanic acid appropriates 3/5ths of the base, although its heat of neutralisation in solution is less than one-third that of phenol, but since the heats of formation of solid potassium cyanide and potassium phenoxide from solid generators are $(20·2 - S)$ and 12·4 Cal. respectively, where S (representing the heat of fusion of solid HCN) is not greater than 4 Cal., it follows that hydrocyanic acid is in reality a stronger acid than phenol. The following data are obtained with hydrogen sulphide (1 mol. in 20 litres):

H_2S dil. + 2KCN dil. = 4·7 Cal.
Na_2S „ + 2HCN „ = 3·2 „
Na_2S „ + HCN „ = 3·1 „
NaHS dil. + HCN dil. = 0·0 Cal.
Na_2S „ + KCN „ = 0·0 „

These results indicate that excess of hydrogen sulphide completely displaces hydrogen cyanide from solutions of its alkali salts.

Analogous conditions of equilibrium exist between carbonic and hydrocyanic acids; those obtaining with the latter compound and boric acid are indicated by the following data:

$$\begin{array}{llll} B_2O_3 \text{ dil. (1 mol. in 4 litres)} & + \text{HCN (1 mol. in 2 litres)} & = 0·0 & \text{Cal.} \\ 2\left\{\begin{array}{l} 2B_2O_3 \quad \text{dil.} \\ 2B_2O_3,K_2O \quad „ \end{array}\right. & \begin{array}{l} +2\text{KCN dil.} \\ +2\text{HCN} \quad „ \end{array} & \begin{array}{l} =14·6 \\ =-3·7 \end{array} & \begin{array}{l} „ \\ „ \end{array} \\ 3\left\{\begin{array}{l} 2B_2O_3 \quad „ \\ 2B_2O_3,K_2O \quad „ \end{array}\right. & \begin{array}{l} +4\text{KCN} \quad „ \\ +4\text{HCN} \quad „ \end{array} & \begin{array}{l} =16·8 \\ =11·6 \end{array} & \begin{array}{l} „ \\ „ \end{array} \end{array}$$

The alkali is shared between the two acids; in experiment 2, which corresponds with the monobasic borate, the hydrocyanic acid takes 1/6th of the base; in experiment 3 (dibasic borate), it takes 4/9ths.

G. T. M.

Dissociation of Ammonio-metallic Salts. By R. Jarry (*Ann. Chim. Phys.*, 1899, [vii], 17, 327—388).—The paper contains descriptions of apparatus employed in preparing ammonio-silver salts and in studying their dissociation.

When a concentrated ammoniacal solution of silver chloride is allowed to evaporate over quicklime, the ammonio-silver chloride, $2AgCl,3NH_3$, separates in colourless, birefractive prisms not affected by light; when the solution is placed over anhydrous calcium chloride, ammonia is removed, and the compound, $CaCl_2,NH_3$, is produced, this has a lower dissociation pressure than the ammonio-silver salt, and accordingly the latter dissociates, yielding crystalline silver chloride. The ammonio-silver chloride, $AgCl,3NH_3$, crystallises in long, colourless, birefractive needles when a solution of silver chloride in liquid ammonia is evaporated at −40° to −20°; the substance is not affected by light. Silver chloride is only slightly soluble in liquid ammonia, and a convenient apparatus is described which obviates the use of large quantities of the solvent in preparing the ammonio-silver chloride crystals. Silver iodide, unlike the chloride or iodide (compare Abstr., 1897, ii, 259, and 1898, ii, 515), is extremely soluble in liquid ammonia, and on allowing the solution to evaporate at −40° to −10°, white, birefractive, lamellar crystals of the ammonio-silver iodide, AgI,NH_3, are obtained; this substance dissociates at 4° under atmospheric pressure, forming a second ammonio-iodide, $2AgI,NH_3$. The dissociation pressures of the two compounds are as follows:

AgI,NH_3.

t	−23°	−13°	0°	6·2°	10·5°	15°	20·5°
p	145	80 [?]	585	820	1055	1380	2020 mm.

$2AgI,NH_3$.

t	0°	19°	37°	39°	52·5°	65°	80°	100°
p	3	12	57	63	155	270	485	1145 mm.

The latter compound is obtained in the crystalline form by the spontaneous evaporation of a solution of silver chloride in concentrated aqueous ammonia; it separates in small, white crystals which become dark violet on exposure to light; during the crystallisation, the pressure of the dissolved ammonia in the liquid surrounding the crystals must be greater than the dissociation pressure of the substance, otherwise the latter dissociates, yielding silver iodide.

Methylammonio-silver bromide, $AgBr,NH_2Me$, is quite analogous to the corresponding chloride (compare Abstr., 1897, i, 455), and is prepared in a similar manner. Its dissociation pressures are as follows:

$AgBr,NH_2Me$.

t	0°	19·5°	20·5°	45·2°	55°
p	11	52	58	290	514 mm.

The following table indicates the solubility of silver bromide in 10 c.c. of aqueous methylamine of different concentrations at 11·5°:

NH_2Me. Grams.	AgBr. Mgrm.	NH_2Me. Grams.	AgBr. Mgrm.	NH_2Me. Grams.	AgBr. Mgrm.	NH_2Me. Grams.	AgBr. Mgrm.
4·844	289	3·562	73	1·797	28	1·317	12
4·311	127	3·258	55	1·513	16	1·101	7

The curve representing these results shows a break corresponding with a solution saturated under the dissociation pressure of $AgBr,NH_2Me$.

The methylammonio-silver iodide, AgI,NH_2Me, obtained like its analogues, forms white, birefractive crystals not affected by light; its dissociation pressures are as follows:

t	0°	15°	25·5°	29·5°	34°	38°	40°	45°	47°	51°	56°	60°
p	35	142	300	403	550	713	803	1130	1210	1360	1575	1745 mm.

At 39°, under atmospheric pressure, this substance is wholly converted into another methylammonio-iodide, $2AgI,NH_2Me$, which gives the following dissociation pressures:

t	0°	19°	34°	47·5°	65°
p	11	34	60	116	228 mm.

These two compounds are very insoluble in aqueous solutions of methylamine, and on this account the latter iodide could not be obtained crystalline.

The dissociation curve of the compound, AgI,NH_2Me, is discontinuous at the point corresponding with the temperature 43° and the pressure 1070 mm.; at this temperature, the substance is seen to melt; the lower portion of the curve therefore represents the dissociation of the solid, and the upper portion that of the liquid, ammonio-iodide.

G. T. M.

Equilibrium in the System, Water–Phenol–Aniline. By FRANS A. H. SCHREINEMAKERS (*Zeit. physikal. Chem.*, 1899, **29**, 577—602).—The equilibrium relations had been previously studied for the system, water–alcohol–succinonitrile (Abstr., 1898, ii, 564), in which two of the pairs form two liquid phases between certain temperature limits. The present system is in this respect similar, but it yields a different form of equilibrium field, and the binodal curves for various temperatures are given, as well as the prismatic representation. The critical mixture temperature of the water–phenol system is 68°, and replacement of phenol by aniline causes a regular increase of this temperature to 167° for the water–aniline system. Curves are also constructed to show the effect of addition of aniline to a mixture of water and phenol in constant ratio, and in this case the critical temperature first rises and then again falls. The addition of salt raises, but that of alcohol lowers, the critical mixture temperature of phenol and water. If one constituent be added to a mixture of the other two, the composition of the homogeneous phase varies for varying ratios of the binary mixture, and curves are given to show the two correlated compositions. The theoretical considerations are postponed.

L. M. J.

False Equilibrium. By PIERRE DUHEM (*Zeit. physikal. Chem.*, 1899, **29**, 711—714).—The author replies to Bodenstein's criticisms (this vol., ii, 639) of the work of Pelabon, and considers that the observations of the former respecting the limits of temperature of formation and false equilibrium of hydrogen sulphide are incorrect. The discrepancies between the results of Bodenstein and of Pelabon are regarded as due to the fact that the former has overlooked the absorption of hydrogen sulphide by liquid sulphur, and on this account the use of indefinite quantities of sulphur militates greatly against the value of his researches. L. M. J.

Fixed Points of Transformation. By HENRI LE CHATELIER (*Compt. rend.*, 1899, **129**, 497—499).—Reversible transformations, such as fusion, allotropic changes, &c., are usually considered to take place under fixed external conditions, but the author does not consider that this is necessarily an absolute law. The equilibrium conditions in a heterogeneous system are $\epsilon - T\eta + Pv - M_1m_1 - \cdots - M_nm_n = 0$, where ϵ, η, v, m, M, are respectively the energy, entropy, volume, mass, and potential, this equation holding for each phase. If, however, changes of magnitude of the particles lead to changes in energy, &c., which may be the case if the particles are very small (for example, the vapour tension of small drops of water), then the above expression may be greater or less than zero. In the former case, the system would be stable, as the subdivided parts would reunite; in the second case, the subdivision could proceed spontaneously, ultimately yielding a homogeneous mixture, and the author does not consider there is any *à priori* reason why this should not occur. Crystalline liquids are, perhaps, cases of the progressive fusion of crystals, but experimental realisation of changes of state at variable tensions is probably difficult.

L. M. J.

"Genesis of Dalton's Atomic Theory." By GEORG W. A. KAHLBAUM (*Zeit. physikal. Chem.*, 1899, **29**, 700—704).—The author replies to certain criticisms of Debus on the German translation, by the author, of the above work of Roscoe and Harden.

L. M. J.

The Place of the New Constituents of the Atmosphere in the Periodic System. By JAMES LEWIS HOWE (*Chem. News*, 1899, **80**, 74—76).—Helium, neon, and argon are considered to be the first three elements of the eighth group in Mendeléef's table of the periodic system. Neon hence follows fluorine, and is the transitional element between the halogen and sodium, whilst argon is a transitional element between chlorine and potassium. Helium is thus in the same horizontal series as hydrogen, but the corresponding element of the halogen series is unknown. Other similar elements could be placed in this group, inasmuch as it is a group containing triads, for example, iron, cobalt, nickel, &c.; and the elements metargon, krypton, xenon may perhaps be placed in it. The author considers the position of elements with no chemical affinity as transition elements from the negative halogens to the positive alkali metals to be probable and natural, and the dissimilarity in properties of these elements and the others of the group, iron, platinum, &c., does not, in his opinion, militate against these views, as dissimilarity from the type elements occurs in other groups. L. M. J.

Inorganic Chemistry.

Solidification of Hydrogen. By JAMES DEWAR (*Compt. rend.*, 1899, **129**, 451—454; *Ann. Chim. Phys.*, 1899, [vii], **18**, 145—149; *Chem. News.*, 1899, **80**, 132—133).—In earlier experiments, liquid hydrogen was allowed to evaporate under 10 mm. pressure, and gave no sign of solidification. Whilst experimenting with some electric resistance thermometers, the wires being immersed in liquid hydrogen, and a small quantity of air entering through leakages and becoming frozen, it was observed that when the pressure was reduced below 60 mm. the whole of the liquid suddenly solidified into a white, froth-like mass like frozen foam. The solid evaporated completely under the low pressure, and melted when the pressure was allowed to rise to 55 mm.; it therefore could not be regarded as frozen air containing liquid hydrogen, and the fact that solidification did not occur in the earlier experiments is attributed to undercooling. This was confirmed by evaporating liquid hydrogen under 30—40 mm. pressure in a special apparatus; it became completely solid, but melted if the pressure was allowed to rise to 55 mm. The sp. gr. of the solid could not be determined, but the maximum sp. gr. of the liquid is 0·086 as compared with 0·07 at its boiling point.

Measurements with constant volume hydrogen thermometers showed that the temperature of the solid under 35 mm. pressure is 16° absolute. The boiling point under 760 mm. pressure is 21° absolute. Calculating from these data, a vapour tension of liquid hydrogen of 55 mm. would correspond with a temperature of 16·7° absolute, hence the melting point of hydrogen must be about 16° or 17° absolute. It may be noted that the critical temperature of hydrogen being 30° to 32° absolute, the melting point is about half the critical temperature. The melting point of nitrogen is also about half its critical temperature. The lowest temperature that can be obtained by evaporation of solid hydrogen under low pressure is 14—15° absolute. C. H. B.

Application of Liquid Hydrogen to the Production of High Vacua, together with their Spectroscopic Examination. By JAMES DEWAR (*Proc. Roy. Soc.*, 1899, **64**, 231—238).—By an extrapolation of the vapour pressure curves of oxygen and nitrogen down to the temperature of boiling hydrogen, the vapour pressure of air at that temperature may be estimated as less than one-millionth of an atmosphere. Vacuum tubes of ordinary shape, suited for the spectroscopic examination of gases, had attached to them a temporary tube, which was immersed for over a minute in liquid hydrogen; the solidification of the air in the interior produced a very high vacuum, as was proved by the extreme difficulty of passing a spark through the tubes.

The process brings about a concentration in the vacuum tubes of the more volatile constituents of the air, and spectroscopic examination of a number of tubes prepared in the above way revealed the presence of neon and helium in a volume of air less than 50 c.c. A number of tubes which had no electrodes showed a carbonic oxide spectrum, due to impurities coming from the glass. Only some tubes showed the hydrogen spectrum, so that the question of the presence of free hydrogen in the air requires further investigation. J. C. P.

Solubility of Bromine in Water. By Ludwig Wilhelm Winkler (*Chem. Zeit.*, 1899, **23**, 687).—Pure bromine and water were shaken for an hour at a constant temperature, a portion of the clear solution was then removed by a capillary pipette and added to a concentrated solution of potassium iodide, the liberated iodine being estimated by the aid of sodium thiosulphate.

The mean results obtained were

Temp.	0°	10·34°	19·96°	30·17°	40·03°	49·85°
Parts of water dissolve 1 part of bromine ...	24	26·74	27·94	29·10	29·02	28·39

Much less bromine is soluble in ice cold water in the presence of bromine hydrate.

Temp.	0°	5·12°
Parts of water dissolve 1 part of bromine	42·39	26·26

The solubility of bromine vapour in water has also been estimated. Bromine water was shaken in a partially filled vessel, the amount of bromine vapour evolved, and also the amount of bromine left in solution were then determined, and, after calculating the pressure of the bromine vapour, its absorption coefficient was calculated.

Temp.	Pressure.	Absorption coefficient.
0°	56—13	60·53
9·94	89—16	35·22
20·46	138—9	20·87
30·38	179—12	13·65
40·31	229—26	9·22
50·25	274—53	6·50
60·04	314—46	4·84
69·98	154—54	3·82
80·22	396—74	2·94

The absorption coefficient obeys the law previously enunciated (Abstr., 1892, 556). Since only so much liquid bromine is dissolved in water as corresponds with the absorption coefficient of bromine vapour and the tension of liquid bromine, it is merely necessary to determine the first two data for a given temperature and then the tension (p) of liquid bromine for that temperature may be calculated by means of the equation $p = b \cdot 760 / \beta . v . 0\cdot0071426$ where b = weight of liquid bromine dissolved by 1 gram of water, β = absorption coefficient of bromine vapour, v = specific volume of water at the given temperature, and 0·0071426 gram is the weight of 1 c.c. of bromine vapour at 0° and 760 mm.

It follows that liquid bromine, as such, is not soluble in water, and that only the vapour dissolves. J. J. S.

Electrolytic Method of preparing Alkali Chlorates, Bromates, and Iodates. By Erich Müller (*Chem. Centr.*, 1899, i, 1061; from *Zeit. Elektrochem.*, **5**, 469—473).—The conversion of potassium hypochlorite into chlorate is accelerated by the addition of potassium chromate, and the current yield is increased from 32·8 to 69·6 per cent. or more. Similarly, alkali bromides and iodides are almost quantitatively oxidised into bromates and iodates respectively in the presence of potassium chromate. Platinum is the most suitable metal for the anode; the use of graphite causing impurities in the salts, and platinum, iron, nickel, or copper may be used as cathodes, but not lead or zinc. In order to avoid the formation of perchlorates, the temperature of the chloride solution should not sink below 25° nor rise above 50°, but perbromates and periodates are not formed from bromides and iodides respectively, even when the solutions are well cooled. The current density may vary within wide limits. Manganese salts have no influence on the formation of chlorates, &c.

E. W. W.

Iodic and Periodic Acids. By Arthur Rosenheim and Otto Liebknecht (*Annalen,* 1899, **308**, 40—67).—The authors' experiments lead them to the following conclusions. (1.) Free iodic acid is dibasic, having the composition $H_2I_2O_6$. (2.) The hydrogen iodates have the composition RHI_2O_6. (3.) The complex iodomolybdates (compare Chrétien, Abstr., 1896, ii, 651) are acid salts of the composition RIO_3MoO_3, analogous to the hydrogen iodates. (4.) When hydrogen iodates or complex iodates are neutralised, the anion is split, and normal iodates (salts of a hypothetical, monobasic iodic acid) are formed. (5.) Periodic acid is pentabasic. (6.) Powerful bases convert periodic acid into stable, monometallic salts, normal salts of a monobasic, meta-periodic acid.

Ammonio-silver iodate, $AgIO_3,2NH_3$, prepared by allowing a solution of silver iodate in concentrated ammonia to evaporate spontaneously over solid potash in a bell-jar, crystallises in long, highly lustrous needles, and becomes greyish-violet when exposed to daylight.

Disilver hydrogen periodate, $Ag_2H_3IO_6$, first described by Magnus and Ammermüller (*Ann. Phys. Chem.*, 1833, [i], **28**, 514), is prepared by suspending the sodium salt, $Na_2H_3IO_6$, in water, adding just enough nitric acid to dissolve it, and treating the solution with neutral silver nitrate at 20°. When the operation is carried out at 100°, the black *salt,* Ag_3IO_5, is produced, but if the disilver periodate is first isolated and then treated with boiling water, the pale yellow colour changes to reddish-brown, and finally black, whilst the liquid becomes acid; by constantly replacing the water until this no longer shows an acid reaction, the *salt,* Ag_5IO_6, is obtained as a black, crystalline powder, and this compound is also produced when disilver hydrogen periodate is treated with ammonia. A boiling solution of the disilver periodate in dilute nitric acid dissolves freshly precipitated silver oxide, forming the black salt, Ag_3IO_5.

The following silver periodates are known at the present time: $AgIO_4$, $Ag_2H_3IO_6$ (and its anhydrides, Ag_2HIO_5 and $Ag_4I_2O_9$), Ag_3IO_5, and Ag_5IO_6; Lautsch's tetrabasic salt, $(Ag_2O)_4I_2O_7$, is not an individual substance.

Pentasodium hexatungstoperiodate, $5Na_2O,I_2O_7,12WO_3+16H_2O$, prepared by boiling a solution of hydrogen disodium periodate with sodium carbonate (1½ mols.) and tungstic acid in slight excess, is the tungsten analogue of Blomstrand's molybdo-salt (Abstr., 1892, ii, 122); it crystallises in microscopic needles, and the aqueous solution gives rise to the corresponding *potassium* salt, with $8H_2O$, *strontium* salt, with $28H_2O$, and *barium* salt, with $12H_2O$.

Trisodium monotungstoperiodate, $3Na_2O,I_2O_7,2WO_3 + 4H_2O$, prepared by adding the disodium periodate (15 grams) in small quantities to a boiling solution of sodium paratungstate (20 grams), forms a white, amorphous mass. The *diammonium sodium* salt, $2(NH_4)_2O,Na_2O,I_2O_7,2WO_3 + 16H_2O$, obtained when ammonia is added to a concentrated solution of sodium hexatungstoperiodate until the precipitate at first formed no longer disappears on stirring, is a crystalline substance. M. O. F.

Action of Hydrogen Chloride on Sulphates, Selenates, Tellurates, and Phosphates. By Raymond W. Tunnell and Edgar F. Smith (*J. Amer. Chem. Soc.*, 1899, **21**, 929—932).—Although selenic and telluric acids are readily expelled from their salts by the action of hydrogen chloride, the method cannot be employed for the separation of sulphates from selenates or tellurates, as a certain amount of sulphuric acid is also replaced, but even at a dull red heat the whole of the sulphuric acid is not removed (compare Heusgen, *Ber.*, 1876, **9**, 1671). At the ordinary temperature, a reaction takes place, the sulphate increasing in weight, probably owing to the formation of a double salt, such as K_2SO_4,HCl. The expulsion of the sulphuric acid takes place more readily in the presence of a selenate or tellurate, and the authors consider it a case of mass action.

Selenic or telluric acid may be completely removed from a mixture of phosphate with selenate or tellurate without the loss of any phosphoric acid. J. J. S.

Character of the Impurity found in Nitrogen Gas derived from Urea. By Lord Rayleigh (*Proc. Roy. Soc.*, 1898, **64**, 95—100).—Nitrogen prepared from carbamide by the action of sodium hypochlorite or hypobromite contains an impurity heavier than nitrogen, the excess amounting to 1—2 per cent. of the weight of pure nitrogen (compare *Phil. Trans.*, A, 1895, 188). When the generating vessel and its charge of hypochlorite were heated previous to the introduction of urea, the weight of impurity was increased. The gas evolved was passed over cold copper turnings, solid caustic potash, and phosphoric anhydride, and only traces of carbonic anhydride or oxygen could be found in the collected gas. With the idea that the impurity was nitrous oxide, the author determined the refractivity of the gas by a method of which details are given, and found that the proportion of impurity indicated in this way was nearly the same as that deduced from the weight. The view that the impurity is nitrous oxide agrees with the observation that it is much more soluble in water than nitrogen. Explosion of the gas with hydrogen gave a contraction rather in excess of the nitrous oxide supposed to be present. It is probable that nitrous oxide is formed by the action of hypobromite on carbamide, as well as in the preparation of nitrogen from chlorine and ammonia. J. C. P.

Densities of 'Atmospheric Nitrogen,' Pure Nitrogen, and Argon. By WILLIAM RAMSAY (*Proc. Roy. Soc.*, 1899, **64**, 181—183). —The density of 'atmospheric nitrogen,' calculated from the densities of the constituents taken in the proportion in which they occur, agrees well with the value found by experiment, whether the figures of Leduc and Schlœsing or those of Lord Rayleigh and Kellas are taken as the basis of calculation. J. C. P.

Free Hydrazine. By CORNELIS A. LOBRY DE BRUYN (*Rec. Trav. Chim.*, 1899, **18**, 297—298. Compare Abstr., 1897, ii, 22).—A preliminary communication relating to the action of sodium, phosphorus, phosgene, sulphurous and carbonic anhydrides, and nitrous oxide on free hydrazine. G. T. M.

Manufacture of Nitrite. By A. DARBON (*Chem. Zeit.*, 1899, **23**, 173—174).—The author describes the method for the manufacture of sodium nitrite by the action of metallic lead on fused sodium nitrate. It is essential that the lead shall be as free as possible from other metals, especially antimony. After fusion, the mass is poured into water, exactly neutralised with nitric or sulphuric acid, in order to precipitate any lead oxide in solution, filtered, and evaporated. Pure nitrite has a neutral, and not, as usually stated, an alkaline reaction. The best method for estimating the nitrite is by the aid of standard potassium permanganate in the presence of dilute sulphuric acid ; in this estimation, only a few c.c. of the acid should be added until the titration is nearly completed, when a larger quantity may be added without any loss of nitrous acid. The pink colour should remain permanent for 15 minutes. J. J. S.

Thioxyarsenic Acids. By LEROY W. McCAY (*Ber.*, 1899, **32**, 2471—2476. Compare Abstr., 1898, ii, 139).—Arsenates cannot be detected by magnesia mixture in the solutions obtained by dissolving arsenic pentasulphide in caustic alkalis or ammonia. The reaction is somewhat complicated, the chief products being thioarsenates and monothioxyarsenates; these salts are always accompanied by small quantities of dithioxyarsenates. The solution of pentasulphide in caustic soda, on digestion with strontium chloride, yields a precipitate consisting of strontium monothioxyarsenate and strontium sodium monothioxyarsenate. *Sodium monothioxyarsenate*, $Na_3AsSO_3 + 12H_2O$, is obtained in long needles by boiling this mixture with sodium carbonate, filtering, and adding alcohol to the filtrate.

Barium dithioxyarsenate is precipitated by adding barium chloride to the filtrate from the strontium monothioxyarsenates; on boiling with sodium carbonate, it yields *sodium dithioxyarsenate*, $Na_3AsS_2O_2 + 10H_2O$, which separates from solution on the addition of alcohol.

Thioarsenates and monothioxyarsenates are also obtained by dissolving arsenic pentasulphide in calcium, strontium, and barium hydroxides.

When hydrogen sulphide is passed into a 1 per cent. solution of arsenic acid, a mixture of arsenic tri- and penta-sulphides and sulphur is precipitated, whilst monothioxyarsenic acid remains in solution ; the latter is freed from unchanged arsenic acid by the addition of magnesia ; the solution, after filtration, contains magnesium monothioxyarsenate; this is converted successively into the potassium, barium, and sodium salts, and by this method 6 grams of crystallised sodium monothioxyarsenate are obtained from 10 grams of arsenic acid. When hydrogen sulphide is passed into a solution of sodium arsenate acidified with mineral acids, a small quantity of dithioxyarsenic acid is produced. G. T. M.

Products of Combustion of Boiler Fuel. By Wilhelm Thörner (*Chem. Zeit.*, 1899, **23**, 331—333).—When coal containing sulphur or pyrites is employed as fuel, sulphuric acid, in addition to sulphurous anhydride, is present in the products of combustion. The whole of this acid does not make its escape; part is deposited on the boiler walls, &c., and it is essential that these should be cleaned regularly. The corroding action of the acid is greater when moisture is present. The formation of the acid may be largely diminished, if not completely avoided, by mixing the coal with lime or by using briquettes made of an intimate mixture of coal with a little lime.

J. J. S.

Action of Chlorine on a Mixture of Silicon, Silica, and Alumina. By Émile Vigouroux (*Compt. rend.*, 1899, **129**, 334—335).—Silicon tetrachloride is readily obtained by the action of chlorine at about a red heat on the mixture of silicon, silica, and alumina obtained by reducing silica with aluminium, and treating the product first with hydrochloric acid and afterwards with aqua regia. The proportion of silicon in this product depends on the relative proportions of silica and aluminium, and on the care taken to cool the reduced mass rapidly and out of contact with air; a mixture of 2 parts of silica and 1 part of aluminium gives good results.

C. H. B.

Preparation, and some of the Properties, of Pure Argon. By William Ramsay and Morris W. Travers (*Proc. Roy. Soc.*, 1899, **64**, 183—192).—'Atmospheric nitrogen' was passed twice over heated magnesium and red-hot copper oxide, the process yielding a gas rich in argon. This gas was then passed (1) through a tube containing a mixture of magnesium powder and lime, heated to a dull red heat in a combustion furnace, (2) over red-hot copper oxide. The whole of the crude argon thus obtained was liquefied in a bulb surrounded by liquid air boiling under a low pressure. When the colourless, mobile, liquid argon is distilled, the first portion to boil off is rich in neon and contains helium, whilst the least volatile portion is metargon. The middle portion is argon, and by a repetition of the process pure argon is obtained.

The density of the gas so purified is 19·957, a value not differing greatly from that previously found, namely, 19·94. The refractivity of pure argon is 0·9665, whilst that of the crude gas was found to be 0·961. Neon and helium have both a low refractivity, and the removal of these gases accounts for the greater refractivity of pure argon. Even at the temperature of boiling oxygen, argon shows no polymerisation, for the ratio pv/T has practically the same value at that as at higher temperatures. J. C. P.

Basic and Ammoniacal Metallic Halogen Salts. By Eugène Tassilly (*Ann. Chim. Phys.*, 1899, [vii], **17**, 38—125).—The results of work already published (compare Abstr., 1894, ii, 92; 1895, ii, 45, 304, 342, and 500; 1896, ii, 350, 360, and 465; 1897, ii, 451; and 1898, ii, 117). G. T. M.

Metallic Sulphides. By A. Mourlot (*Ann. Chim. Phys.*, 1899, [vii], **17**, 510—574).—An account of work already published (compare Abstr., 1896, ii, 25, 304, 603; 1897, ii, 372; 1898, ii, 376; this vol., ii, 27 and 97). G. T. M.

Metallic Thiophosphates. By Lucien Ferrand (*Ann. Chim. Phys.*, 1899, [vii], **17**, 388—432).—An account of work already published (compare Abstr., 1895, ii, 389; 1896, ii, 418 and 473). G. T. M.

Action of Sodammonium and Potassammonium on Tellurium and on Sulphur. By C. Hugot (*Compt. rend.*, 1899, **129**, 388—390).—The following compounds have been prepared by the action of sodammonium and potassammonium on tellurium and on sulphur, the method of preparation being the same as that used for obtaining the corresponding selenium compounds (this vol., ii, 650).

With excess of alkali metal, the monotellurides Na_2Te, and K_2Te, and the monosulphides, Na_2S, and K_2S, are obtained as white, amorphous substances, soluble in water, insoluble in liquefied ammonia; they do not absorb ammonia gas. With excess of tellurium or sulphur, the polytellurides or polysulphides Na_2Te_3, K_2Te_3, Na_2S_5, K_2S_5 are formed as crystalline compounds which are soluble in water and in liquefied ammonia and absorb ammonia gas. The tellurium used in the preparation of the above compounds was obtained from commercial tellurium, and was purified according to the methods of Metzner and Ditte (Abstr., 1898, ii, 572). H. R. Le S.

Dehydration of Sodium Phosphate Crystals. By T. C. Whitlock and C. E. Barfield (*Amer. Chem. J.*, 1899, **22**, 214—215).—The water of crystallisation of disodium hydrogen phosphate is removed by heating for 1 hour at 180°, whilst the water of constitution begins to be lost at 230°, and is completely removed in 1 hour at 300°. W. A. D.

Persulphates of Rubidium, Cæsium, and Thallium. By Arnott R. Foster and Edgar F. Smith (*J. Amer. Chem. Soc.*, 1899, **21**, 934—936).—*Cæsium* and *rubidium persulphates*, $Cs_2S_2O_8$ and $Rb_2S_2O_8$, are obtained as white precipitates when solutions consisting of two-thirds of sulphuric acid of sp. gr. 1·35 and one-third of a saturated solution of the metallic sulphate are electrolysed in a Nernst "divided cell," surrounded by a freezing mixture. 100 parts of water dissolve 3·32—3·49 parts of rubidium persulphate at 22·5°, and 8·71—8·98 parts of cæsium persulphate at 23°.

A white precipitate was also obtained when thallium sulphate solution was electrolysed in a similar manner, but it could not be analysed on account of its instability. J. J. S.

New Explosive and Detonating Materials. By Ugo Alvisi (*Gazzetta*, 1899, **29**, ii, 64—81. Compare this vol., ii, 414).—From the results of a large number of tests of explosives and detonators, it is seen that the addition of ammonium perchlorate to a mercury fulminate detonator gives a greater effect with a dynamite only when the latter also contains ammonium perchlorate, and in this case the best detonating mixture consists of equal parts of ammonium perchlorate and mercury fulminate. For dynamite without perchlorate, the greatest effect is obtained with a detonator containing 17—20 per cent. of the perchlorate and 80—83 per cent. of the fulminate.

T. H. P.

Ammonio-silver Nitrate. By Marcellin Berthelot and Marcel Delépine (*Compt. rend.*, 1899, **129**, 326—330).—The reaction $AgNO_3$ diss. $+ 2NH_3$ diss. $= AgNO_3,2NH_3$ diss. develops $+13·35$ Cal. and the addition of either ammonia or silver nitrate produces no appreciable thermal disturbance, which shows that the compound is not dissociated in solution. The action of nitric acid on the ammoniacal silver nitrate solution develops $+12·25$ Cal., and this gives for the heat of combination $+13·15$ Cal. The author considers that silver oxide is first liberated and then converted into ammonio-silver oxide, $(NH_3Ag)_2O$, which immediately acts on the ammonium of the ammonium nitrate, forming a complex base, $NH_3(NH_3Ag)$, which exists in the ammonio-silver salts already known. The corresponding oxide in the solid state is identical with fulminating silver.

The dissolution of silver oxide in dilute ammonia develops $+10·45$ Cal., which is the heat of formation of the dissolved oxide, and is confirmed by indirect methods. Its heat of neutralisation by dilute nitric acid is $+13·62$ Cal., and therefore the energy of its basic function is comparable with that of potassium and sodium hydroxides. Ammonio-silver nitrate is readily obtained in crystals, as described by previous observers, and its heat of dissolution at $-15°$ is $-8·96$ Cal. (4 litres) and $-8·58$ Cal. (2 litres). Its heat of formation from its elements is $+78·45$ Cal., and from solid silver nitrate and gaseous ammonia, $+34$ Cal. Its resolution into gaseous water, silver, and nitrogen develops $+87·15$ Cal., which explains its explosive properties.

C. H. B.

Solubility of Lime in Water and Saccharine Liquids. By Julius Weisberg (*Bull. Soc. Chim.*, 1899, [iii], **21**, 773—776).—Determinations of the solubility of lime in water at 15° and at 20° gave results in close agreement with those of Herzfeld. The results of a number of experiments on the solubility of lime in sugar solutions of different strengths at 15° and at 16—17° are given in tabular form and compared with those obtained by Berthelot, Péligot, Petit, and Schatten. Péligot's tables, although most generally used, are considered to be the least accurate, and the solubilities given by previous experimenters are in each case lower than the values obtained by the author. The solubility increases with the amount of sugar present, but the weight of lime dissolved per 100 grams of sugar is greater in weak than in strong sugar solution. Anhydrous calcium oxide is more soluble in sugar solutions than calcium hydroxide, a result previously obtained by Herzfeld, Loiseau, and by the author, and now again confirmed. N. L.

Calcium Carbide as a Reducing Agent in Analysis in the Dry Way. By N. Tarugi (*Gazzetta*, 1899, **29** i, 509—512).—When cupric oxide is heated to a bright red heat (1408°) with five times its weight of calcium carbide, it is completely reduced to metallic copper. By carefully washing with water the mixture of excess of carbide and alloy formed, metallic leaves containing 5—8 per cent. of calcium are obtained; this alloy is unstable and renders water alkaline and turbid. If the washing is continued until the water effects no further change, the percentage of calcium in the alloy is reduced to 1·27—1·5, the substance thus obtained having a sp. gr. 8·329 and remaining unchanged in the air. Salts of copper act similarly to the oxide.

In salts of lead, calcium carbide effects reduction at about 400°, the alloy formed containing about 8 per cent. of calcium; this substance is more readily decomposed by water than the copper compound, and when freshly prepared has a lustrous surface which in the air rapidly gives place to a whitish efflorescence. With lead chromate, besides the alloy of lead and calcium, free chromium is also obtained. All salts of gold, silver, platinum, tin, bismuth, antimony, cadmium, zinc, nickel, and cobalt, on heating with calcium carbide, give calcium alloys readily decomposable by water. Mercury and arsenic salts deposit free mercury and arsenic.

The author recommends the use of calcium carbide in analysis in place of potassium cyanide or formate or the action of the reducing flame. T. H. P.

Electro-deposition of Brass. By T. J. Baker and T. J. Baker, junr. (*Chem. News*, 1899, **80**, 37).—Quantitative electrolytic experiments were made with solutions of copper and zinc cyanides, alone and mixed, the hydrogen evolved being measured and the metal deposited weighed, both from these solutions and from a copper sulphate cell in series with the cyanide solution. The electrochemical equivalent of copper which is deposited from its cyanide solution, whether alone or with zinc, as brass, is always that of the metal in its cuprous state. D. A. L.

Precipitation of Copper by Zinc. By John C. Shengle and Edgar F. Smith (*J. Amer. Chem. Soc.*, 1899, **21**, 932—933).—Although the precipitation of copper by zinc is recommended as a method for the quantitative estimation of copper and gives good results, experiments made by the authors prove conclusively that small amounts of zinc (1—3 per cent.) are always present in the precipitated copper and that the good results are due largely to a balancing of errors. Similarly, silver and copper deposited by the aid of cadmium always contains small quantities of the latter metal. J. J. S.

Action of Hydrogen Phosphide on Copper Oxide, Hydroxide, and Carbonate. By E. Rubénovitch (*Compt. rend.*, 1899, **129**, 336—338).—Cupric oxide, prepared by heating the nitrate, is readily attacked by hydrogen phosphide, at first slowly, and afterwards more rapidly, with considerable development of heat, copper phosphide, P_2Cu_5, phosphoric acid, and water being formed. Cupric hydroxide is attacked by hydrogen phosphide with great energy, and the proportion of phosphoric acid formed varies considerably, but if the reaction is moderated, it tends to proceed in the same manner as with the oxide.

The basic carbonate, $2[CuCO_3,Cu(OH)_2] + H_2O$, is attacked by hydrogen phosphide with considerable development of heat, the reaction being $5PH_3 + 5[CuCO_3,Cu(OH)_2] = 2P_2Cu_5 + H_3PO_4 + 5CO_2 + 11H_2O$.

The phosphide P_2Cu_5 is obtained by passing a mixture of hydrogen phosphide and carbonic anhydride over cupric carbonate, and the phosphide PCu_3 is obtained by treating cuprous oxide in the same way.
C. H. B.

Cupric Hypophosphite and its Decomposition by Precipitated Palladium. By Rodolphe Engel (*Compt. rend.*, 1899, **129**, 518—520).—Cupric hypophosphite is obtained by mixing cupric sulphate and barium hypophosphite solutions and adding alcohol. It forms a brilliant, white precipitate of the composition $Cu(H_2PO_2)_2$, and is somewhat stable both in the solid state and in solution. The solid explodes suddenly at about 90°; a dilute solution can be boiled without decomposing. Precipitated palladium decomposes cupric hypophosphite solutions in accordance with the following equation: $Cu(H_2PO_2)_2 + 2H_2O = Cu + 2H_3PO_3 + H_2$, and copper hydride is not formed. If, however, an aqueous solution of the salt is boiled, brown cuprous hydride is first precipitated and rapidly splits up into hydrogen and copper. In the first phase of the reaction, hypophosphorous acid is formed, but is slowly oxidised by the copper at about 100°, whereas with palladium this oxidation takes place at the ordinary temperature.

Hypophosphorous acid and palladium completely reduce bismuth and antimony salts at the ordinary temperature, but in the case of lead and stannous salts the precipitation of the metal interferes with the activity of the palladium.
C. H. B.

Mercury Derivatives of Nitrogen Compounds. By Leone Pesci (*Zeit. anorg. Chem.*, 1899, **21**, 361—376).—The author points out that the evidence brought forward by Hofmann and Marburg (this vol., i, 486) in support of the formulæ $NH_2{\cdot}HgCl$ and $Hg(NH_3)_2Cl_2$ for the infusible and fusible white precipitates obtained from mercuric chloride and ammonia in the presence of a large proportion of ammonium chloride, is unsatisfactory for the following reasons. The decomposition of these salts by a boiling 20 per cent. solution of potassium hydroxide, whereby all the nitrogen is eliminated in the form of ammonia, is no evidence as to their constitution, for mercuriammonium chloride, when treated in this manner, also parts with all its nitrogen. If, however, the infusible precipitate is treated with reagents which decompose ammonium salts but do not decompose mercuriammonium chloride, such as a 2 per cent. solution of potassium hydroxide or a solution of sodium carbonate, one-half only of the nitrogen is eliminated in the form of ammonia, and the theoretical quantity of mercuriammonium chloride is obtained. This reaction is in accordance with the formula Hg_2NCl,NH_4Cl. The fusible precipitate, when treated in the same manner, yields three-fourths of its nitrogen in the form of ammonia, together with the quantity of mercuriammonium chloride theoretically required for the formula $Hg_2NCl,3NH_4Cl$.

The author maintains that the mercuriammonium salts are all represented by the type Hg_2NX, and are derived from the hydroxide $Hg_2N\cdot OH$, which readily yields complex compounds when treated with ammonium salts. Millon's base is therefore represented by the formula $Hg_2N\cdot OH,2H_2O$. The salts obtained from this compound by Hofmann and Marburg by the action of hydrochloric, nitric, and hydrobromic acids were probably not pure. E. C. R.

Action of Potassium Iodide on Mercurous Iodide. By Maurice François (*J. Pharm.*, 1899, [vi], **10**, 16—18. Compare Abstr., 1896, i, 22; ii, 248, 301; and 1897, ii 492).—A solution of potassium iodide decomposes mercurous iodide into mercuric iodide and mercury. If mercury is allowed to remain in contact with a solution of potassium iodide saturated with mercuric iodide, the reverse action takes place, mercurous iodide being formed. In both cases, the action is limited, and for a temperature of 20° equilibrium is established between the reacting substances, when the liquid contains 11·9 per cent. of mercuric iodide. H. R. Le S.

Photographic Researches on Phosphorescent Spectra: Victorium, a new Element associated with Yttrium. By Sir William Crookes (*Proc. Roy. Soc.*, 1899, **65**, 237—243).—The method of separating victoria from earths of the cerium group and from yttria is described in detail. Long-continued fractionations (*a*) by fusion and partial decomposition of the nitrates, (*b*) by crystallisation of the oxalates, and (*c*) by precipitation with potassium sulphate, were had recourse to in succession, and the course of the fractionation is shown by a diagram.

Victoria is an earth of a pale brown colour, easily soluble in acids, and less basic than yttria. Assuming the oxide to have the formula Vc_2O_3, the atomic weight is about 117. The best material for phosphorescing in a vacuous tube is, not the earth itself, but the anhydrous sulphate; the photographed phosphorescent spectrum contains a pair of strong lines at about λ3120 and 3117, and other fainter lines at 3219, 3064, 3060. J. C. P.

Porcelain from Egypt. By Henri Le Chatelier (*Compt. rend.*, 1899, **129**, 387—388).—An analysis of a sample of Egyptian porcelain which came from Saggarah (Memphis) gave the following results: Na_2O, 5·8; CuO, 1·7; CaO, 2·1; Al_2O_3, 1·4; Fe_2O_3, 0·4; SiO_2, 88·6 per cent. The above composition is totally different from that of Chinese porcelain, and as the sample was undoubtedly of Egyptian origin, the author believes that the ancient Egyptians did manufacture real porcelain. A porcelain identical to the above may be produced by fusing a mixture of 40 parts blue glass, 50 parts fine sand, and 5 parts white clay. H. R. Le S.

Egyptian Pottery. By HENRI LE CHATELIER (*Compt. rend.*, 1899, **129**, 477—480).—The statuettes found in Egyptian tombs were regarded by Salvétat as carved out of a natural grit, the glaze being a sodium calcium silicate containing copper. The author finds, however, that statuettes from several different localities consist mainly of fine grains of quartzose sand, mixed with a small quantity of clay, which serves as a cement. The glaze is a mixture of grains of sand with a glass of the composition 4 SiO_2, 0·33 CuO, 0·67 Na_2O. C. H. B.

Chemical Equilibrium between Manganous Hydroxide and Ammonium Salts. By W. HERZ (*Zeit. anorg. Chem.*, 1899, **21**, 243—249).—The statement that manganous salts are not precipitated by ammonia in the presence of ammonium salts is not quite correct. A mixture of equal volumes of normal solutions of manganous sulphate and ammonium chloride in an atmosphere of hydrogen gives a cloudiness on the addition of about one and a-half times the quantity of $N/10$ ammonia solution; the further addition of ammonia does not appreciably increase the precipitate, which is deposited after the mixture has remained for some hours. The author has examined the reaction which takes place when manganous hydroxide is treated with solutions of ammonium chloride, nitrate and sulphate in an atmosphere of hydrogen, as expressed by the equation $Mn(OH)_2 + 2NH_4Cl \rightleftharpoons MnCl_2 + 2HN_4OH$. The reaction does not follow the laws of mass reaction, and the results do not agree with those obtained by Lovén for magnesium salts (Abstr., 1896, ii, 413). The abnormal results are probably due to the combination of the manganese and ammonia to form complex cations. E. C. R.

Decomposition of Monomanganous Phosphate by Water at 0° and at 100°. By GEORGES VIARD (*Compt. rend.*, 1899, **129**, 412—414. Compare this vol., ii, 26).—Monomanganous phosphate, $MnH_4(PO_4)_2 + 2H_2O$, dissolves in 100 times its weight of water at 0° without appreciable decomposition, but as the weight (P) of the salt which is added to the water increases, more and more of the dibasic phosphate, $Mn_2H_2(PO_4)_2 + 6H_2O$, is precipitated, and the ratio (R) of the total phosphoric acid remaining in solution to the combined phosphoric acid increases from 1·06 to 1·19 as P increases from 10 to 100. When heated with water at 100°, the precipitate consists solely of Erlenmeyer and Heinrich's ditrimanganous phosphate, $Mn_2H_2(PO_4)_2 + Mn_3(PO_4)_2 + 4H_2O$, but in this case the ratio R increases rapidly until a maximum value of 1·88 is reached, when $P = 20$, and then slowly decreases until, when $P = 150$, it becomes sensibly constant and equal to about 1·5. N. L.

Destructive Action of Water containing Free Carbonic Anhydride on Iron. By OTTO KRÖHNKE (*Chem. Centr.*, 1899, i, 907—908; from *Gesundheit*, **14**, 72—75).—The water of St. Johann a/Saar, which is of only 2° hardness and contains 38 milligrams of free carbonic anhydride per litre with only traces of carbonates, was found to attack iron conduit pipes, forming a rust of the following composition: Fe_2O_3, 72·76 per cent.; Fe, 13·95; H_2O, 8·69; CO_2, 2·9; $CaSO_4$, 0·78; Cl, traces; soluble in hydrochloric acid, 0·5. This action, which must be due to the free carbonic anhydride present, is decreased by the addition of calcium salts for the presence of a certain quantity of calcium hydrogen carbonate causes the formation of a layer of calcium carbonate which protects the iron from further corrosion. Neither the rust nor the water after its passage through the pipes contained sulphides or iron sulphate, hence Rosenblum's theory of the process according to which free hydrogen is assumed to reduce the calcium sulphate to sulphide, which is then decomposed by the carbonic anhydride with liberation of hydrogen sulphide, is not confirmed.

E. W. W.

Action of Sulphurous Acid on Metallic Sulphates, especially on Ferric Sulphate. By UBALDO ANTONY and E. MANASSE (*Gazzetta*, 1899, **29**, i, 483—488).—Manganese, nickel, cobalt, and ferrous sulphates are not affected when sulphurous anhydride is passed through their aqueous solutions. In the case of ferric sulphate, however, the action is similar to that on ruthenium sulphate (Antony and Lucchesi, this vol., ii, 299), ferrous dithionate being formed. Using a 2 per cent. solution of ferric sulphate at 0°, equilibrium is reached when 80 per cent. of the total sulphate has been converted into dithionate; this percentage diminishes as the temperature rises until, at 95°, no conversion takes place.

T. H. P.

A new Hydrate of Ferrous Potassium Sulphate, and the Relative Solubilities of the various Hydrates of this Salt. By FRIEDRICH W. KÜSTER and A. THIEL (*Zeit. anorg. Chem.*, 1899, **21**, 116—121).—When molecular quantities of ferrous sulphate and potassium sulphate in mixed solution are allowed to crystallise between 35° and 85°, a pale green salt of the composition $K_2SO_4.FeSO_4 + 4H_2O$ separates. The colourless hydrate, $K_2SO_4,FeSO_4 + 2H_2O$, crystallises as the stable form above 90°, but if allowed to cool in contact with the mother liquor, is transformed into the tetrahydrated salt.

The relative stability of the three hydrates, with six, four, and two molecules of water, is shown by a comparison of their solubilities at various temperatures. Nearly saturated solutions of each were shaken up with a further quantity of the same hydrate, and the amount in solution was determined at intervals by titration of a portion with permanganate. At temperatures where the hydrate under examination is stable, the volume of permanganate used reaches a maximum and remains permanently constant.

If the hydrate is unstable at the temperature of the experiment, the volume of permanganate used reaches a maximum, and then gradually alters until the value is reached corresponding with the stable hydrate. The temperature of transformation for the pair of hydrates with six and four molecules of water is about 30°, for the pair with four and two molecules about 87°, and for the pair with six and two molecules about 54°.

J. C. P.

Atomic Weight of Cobalt. By THEODOR WILLIAM RICHARDS and GREGORY PAUL BAXTER (*Zeit. anorg. Chem.*, 1899, **21**, 250—272. Compare Abstr., 1898, ii, 377).—The authors have determined the weight of cobalt obtained from a known weight of cobalt bromide by reducing it in a current of hydrogen. The apparatus employed and the method of conducting the analysis are the same as those previously employed for the determination of the atomic weight of nickel (this vol., ii, 488). The cobalt bromide (similarly to the nickel bromide) contains a small quantity of sodium bromide, and this is estimated by extracting the reduced cobalt with water and precipitating with silver. The metallic cobalt resembles nickel in being slightly attacked and dissolved by water, but the solution is quickly oxidised in the air and all the cobalt precipitated as cobalt hydroxide, so that, after separating this by filtration, the weight of the impurities can be obtained by evaporating the solution to dryness and weighing. The authors' experiments prove that the cobalt bromide is completely reduced, and that the impurities are entirely extracted from the reduced metal by water. The complete analysis of the cobalt bromide gave 26·923 per cent. Co, 72·981 per cent. Br combined with the cobalt, 0·070 per cent. Br in the impurities, and 0·033 per cent. Na = 100·007. The mean of twelve determinations gave as the atomic weight of cobalt, Co = 58·995, the extreme values being 59·021 and 58·955 [O = 16]. The results do not agree so closely as those obtained for nickel, and the authors are engaged in a further determination of the atomic weight by a different method. E. C. R.

Chromylamide. By JULIUS OHLY (*Chem. News*, 1899, **80**, 134).—By treatment with dry ammonia, potassium chlorochromate yields potassium amidochromate, $KO\cdot CrO_2\cdot NH_2$, and this, when dissolved in water, mixed with concentrated ammonia, covered with a layer of ether and treated with chlorine, yields a light brown solution which deposits yellowish-brown, dull, metallic leaflets of *chromylamide*, $CrO_2(NH_2)_2$. It evolves ammonia when rubbed with soda-lime, is soluble in water, and its solution gives amide reactions with silver nitrate and lead acetate. D. A. L.

Tungsten Chlorobromides. By ED. DEFACQZ (*Compt. rend.*, 1899, **129**, 515—518).—When liquid hydrogen bromide is allowed to act on tungsten hexachloride at the ordinary temperature, it yields the chlorobromide WCl_3Br_3, whilst at 60—70° the compound $WCl_6,3WBr_6$ is obtained. The latter forms small, olive-green crystals which melt at 232° and dissolve in many organic solvents. It is very unstable, alters rapidly when exposed to air, is immediately decomposed by water, and by steam at 200°, and is readily attacked by hydrogen, oxygen, chlorine, sulphur, phosphorus, halogen hydracids, hydrogen sulphide, nitric and sulphuric acids, alkalis, oxidising mixtures, and potassium hydrogen sulphate. The compound WCl_3Br_3 is very similar in appearance and properties. C. H. B.

Chloriodides [and Bromiodides] of Tin. By C. LENORMAND (*J. Pharm.*, 1899, [vi], **10**, 114—117. Compare this vol., ii, 33).—When the compound $SnCl_2I_2$ is fractionally distilled in air, the liquid which passes over at 280° solidifies to a mass of orange-red crystals of the composition $SnClI_3$. When the fraction 126—180° is redistilled in a vacuum, the distillate consists of stannic chloride, and the residue of the chloriodide, $SnCl_3I$ or $SnCl_2I_2$, according to the proportion of liquid which has passed over. When the compound $SnCl_2I_2$ is distilled in a vacuum, the distillate consists of stannic chloride, and the residue of stannic iodide.

Iodine is without action on stannous bromide at the ordinary temperature, but at 100° an energetic action takes place, and the compound $SnBr_2I_2$ is formed. This crystallises in hexagonal plates, melts at 50°, boils at 225°, and has a sp. gr. 3·631 at 15°. It is only slightly soluble in cold, but readily in warm, water, and at 80° its aqueous solution is decomposed into hydrated oxide of tin, and hydrogen bromide and iodide. When distilled in air, the bromiodide $SnBr_3I$ passes over between 230° and 250°, and $SnBr_2I_2$ between 250° and 275°, the residue consisting of the compound $SnBrI_3$. Distilled in a vacuum, it boils at 130° and partially distils, the temperature gradually rises to 180°, where it remains stationary, and the compound $SnBr_3I$ passes over whilst the residue in the flask has the composition $SnBrI_3$.

H. R. Le S.

Electro-deposition of Vanadium. By Sherard Cowper-Coles (*Chem. News*, 1899, **79**, 147—148).—Vanadium can be obtained as a brilliant, metallic deposit by a current of 18 to 20 ampères per square foot and an E.M.F. at the terminals of the electrolysing cell of 1·88, using a solution of the following composition and working at 82·5°: 1·75 parts of vanadic anhydride dissolved in 2 parts of caustic soda and 160 parts of water and then treated with 32 parts of hydrochloric acid.

D. A. L.

Influence of Oxidising Substances on the Solubility of Gold in Alkali Cyanides. By Emilio Noelting and G. Forel (*Chem. Centr.*, 1899, i, 823—824; from *Bull. Soc. ind. Mulhouse*, 1899, 28—43).—The solubility of gold in solutions of alkali cyanides is considerably increased by the addition of α-nitroso-β-naphthol, α-nitroso-α-naphthol, β-nitroso-α-naphthol, the nitroso-salt,

$$C_{10}H_4O(SO_3Na)_2\!:\!NOH\ [NOH:O:(SO_3Na)_2]=1:2:3:6],$$

nitrosophenol, dinitrosoresorcinol, and nitrobenzene, and to a less extent by orthonitrophenol, potassium ferricyanide, ammonium persulphate, quinonedichlorimide, picric acid, sodium isopurpurate, and oil of turpentine. The solubility is not affected by the presence of potassium nitrite or ammonium vanadate, but it is decreased by ether, chloranil, quinone, β-naphthaquinone, phenanthraquinone, and magenta, whilst methylene-blue and Ponceau-2R render gold insoluble.

The coefficients of solubility under given conditions of temperature, time, concentration of the solution, quantities of cyanide employed, &c., are given in tables in the original paper.

E. W. W.

Electro-deposition of Palladium. By Sherard Cowper-Coles (*Chem. News*, 1899, **79**, 280).—For the deposition of palladium in a bright form, a 0·62 per cent. solution of palladium ammonium chloride, in a 1 per cent. solution of the same salt [? of ammonium chloride] is employed. The solution is maintained at a temperature of about 24°, the current used per square foot being about 0·12 ampère, and the E.M.F. at the terminals of the bath 4 to 5 volts.

D. A. L.

Ruthenium and its Compounds. II. Potassium Ruthenichloride. By Ubaldo Antony and Adolfo Lucchesi (*Gazzetta*, 1899, **29**, ii, 82—84. Compare this vol., ii, 558).—Potassium ruthenichloride is obtained in a pure state by the following method. A mixture of 6 parts of potassium hydroxide and 1 part of powdered ruthenium is heated to fusion in a silver basin, and potassium chlorate added in small quantities with stirring until the ruthenium is completely dissolved. After heating at a high temperature until all evolution of gas ceases, the excess of chlorate being then decomposed, the cold mass, which is of an orange-red colour, is dissolved in cold water, and very dilute hydrochloric acid added until the solution gives a decided acid reaction. When allowed to evaporate at the ordinary temperature in a vacuum over quicklime, this liquid gradually deposits the ruthenichloride which is purified by repeated crystallisation. Thus prepared, potassium ruthenichloride, K_2RuCl_6, is a reddish-brown powder composed of very minute crystals; in cold water, it is very slightly soluble, but in presence of potassium chloride quite insoluble, and in hot water it dissolves readily with partial decomposition.

T. H. P.

Mineralogical Chemistry.

Albertite-like Asphalt from Indian Territory, U.S.A. By Joseph A. Taff (*Amer. J. Sci.*, 1899, [iv], **8**, 219—224).—The material described occurs as strings and veins, up to 25 feet thick, in greenish shales at several localities in the McAlister Quadrangle, Choctaw Nation, Indian Territory. It is jet-black, and in the upper parts of the veins is very friable with an uneven fracture, whilst at greater depths it has a smooth, conchoidal fracture. When heated, it softens and decomposes without fusing, but the distillation products differ from those of coal. It is soluble to the extent of over 35 per cent. in carbon bisulphide, and is almost insoluble in turpentine; it thus differs from coal, which is insoluble in carbon bisulphide, and from albertite, which is largely soluble in turpentine. Analyses, I by W. F. Hillebrand, and II by W. C. Day, were made on different samples of material.

	C.	H.	N.	S.	O.	Ash.	H_2O.	Fixed C.	Volatile combustible material.	Sp. gr.
I.	—	—	—	1·47	—	1·45	0·25	55·97	42·33	—
II.	86·57	7·26	1·48	1·38	2·00	1·31	—	—	—	1·175

L. J. S.

Composition of Natural Thio-salts. By Constantin Guillemain (*Inaug. Diss., Breslau*, 1898, 47 pp. Compare *Jahrb. f. Min.*, 1899, ii, Ref. 190—195).—The results are given of 37 analyses made on various mineral thio-salts; in most cases, only massive material was used, and in only one instance was the material determined crystallographically. In the method of analysis, the material was first decomposed by nitric acid.

Emplectite, acicular crystals in quartz from Tannenbaum, Saxony; after deducting more than 50 per cent. of quartz, the mean (I) of two analyses agrees with Cu_2S,Bi_2S_3.

Aikinite (patrinite), acicular crystals in quartz from Beresovsk, Urals; after deducting about 75 per cent. of quartz, the mean (II) of two analyses agrees with $PbCuBiS_3$.

		Bi.	Cu.	Pb.	S.	Total.
Emplectite...	I.	61·95	18·80	—	19·16	99·91
Aikinite......	II.	36·22	11·01	35·58	16·58	99·39

Zinckenite, from Wolfsberg, Harz; anal. III, on a drusy mass of crystals; IV, on massive material. Formula, PbS,Sb_2S_3.

Dufrenoysite, from the Binnenthal, Switzerland; V, on crystal fragments from the surface; VI, the underlying material. Formula, $2PbS,As_2S_3$.

Jamesonite, VII, feather ore (a soft, felty mass of fine fibres and needles) from Wolfsberg, Harz; VIII, feather ore from Bräunsdorf, Saxony; IX, minute crystals in cavities of massive material (anal. X) from Arnsberg, Westphalia [compare heteromorphite, this vol., ii, 431]; XI, massive, from Wolfsberg; XII, feather ore from Wolfsberg. Analyses VII—X give the formula $2PbS,Sb_2S_3$; the other two, and previous analyses not agreeing with this formula, are assumed to contain admixed stibnite.

Boulangerite, XIII, compact, finely granular material from Ober-Lahr on the Rhine; XIV, ditto, from Betzdorf on the Sieg; XV, ditto, from San Antonio, California; XVI and XVII, Websky's "epiboulangerite," containing admixed galena, from Altenberg, Silesia. Of these, XIII and XV give the formula $3PbS,Sb_2S_3$; previous analyses not agreeing with this formula are supposed to contain admixed stibnite, jamesonite, pyrites, &c. (compare Abstr., 1898, ii, 29).

Geocronite, XVIII, massive, from Sala, Sweden; mean of two analyses giving the formula $5PbS,(Sb,As)_2S_3$.

Bournonite, XIX, mean of two analyses on crystal fragments from Liskeard, Cornwall; XX, mean of two analyses on material from Wolfsberg, Harz; Formula, $PbCuSbS_3$.

Jordanite, anal. XXI, bright crystals with twin lamellæ, from the Binnenthal, Switzerland; sp. gr. 5·48; formula, $4PbS,As_2S_3$. XXII is the mean of three analyses made on dull, black material from the Binnenthal; it is much fractured, and is coated with a white crust of arsenious acid; it is probably altered jordanite; formula, $Pb_6As_2S_{10}$.

Enargite, XXIII, mean of four analyses on massive material intergrown with pyrites, from San Juan Co., Colorado; XXIV and XXV, each the mean of two analyses on massive material intergrown with pyrites, from Morococha, Peru; formula, $Cu_7As_2S_9$.

		As.	Sb.	Pb.	Cu.	Fe.	S.	Total.
Zinckenite	III.	—	42·43	33·52	0·80	—	23·01	99·76
	IV.	—	42·15	34·33	0·70	0·06	22·63	99·87
Dufrenoysite	V.	21·01	—	57·38	—	—	21·94	100·33
	VI.	20·04	—	56·73	—	—	21·18	97·95
Jamesonite	VII.	—	30·04	50·32	—	—	19·69	100·05
	VIII.	—	29·03	51·71	—	—	19·23	99·97
	IX.	—	29·49	50·57	—	—	19·91	99·97
	X.	—	29·51	50·36	—	—	20·15	100·02
	XI.	—	30·73	49·49	—	—	19·68	99·90
	XII.	—	31·23	48·25	—	—	20·32	99·80
Boulangerite	XIII.	—	22·69	58·58	—	—	18·76	100·03
	XIV.	—	23·82	57·23	—	—	18·23	99·28
	XV.	—	22·76	59·01	—	—	18·22	99·99
	XVI.	—	16·26	63·73	—	2·42	17·53	99·94
	XVII.	—	14·63	66·06	—	2·34	16·83	99·86
Geocronite	XVIII.	4·54	9·27	68·90	—	—	17·13	99·84
Bournonite	XIX.	—	25·38	41·42	12·99	—	19·92	99·71
	XX.	—	24·30	42·36	13·28	—	19·91	99·85
Jordanite	XXI.	12·46	—	68·67	—	—	18·81	99·94
	XXII.	8·97	—	72·44	—	—	18·58	99·99
Enargite	XXIII.	15·27	1·59	—	47·80	1·31	33·84	99·81
	XXIV.	16·53	—	—	46·25	2·19	34·89	99·86
	XXV.	15·34	1·26	—	46·92	1·51	34·49	99·52

L. J. S.

Cerium in Bismutite from Argentina. By GUILLERMO BODENBENDER (*Zeit. prakt. Geol.*, 1899, 322—323).—Bismutite occurs in a vein in gneiss at La Toma, Sierra de San Luis; it is grey and compact, or forms a granular, crystalline aggregate with fibrous fracture and silky lustre. Embedded in it are quartz, mica, and grains of columbite, and it is sometimes coated with bismuth ochre. Analysis gave:

Bi_2O_3.	CO_2.	H_2O.	CaO.	MnO.	FeO.	Ce_2O_3.	Total.
80·7	8·7	1·9	6·7	0·8	0·3	0·54	99·6

L. J. S.

Formation of Corundum in Magmas. By JULIUS H. PRATT (*Amer. J. Sci.*, 1899, [iv], 8, 227—231).—The author has previously noted the occurrence of chromite, corundum and spinel in the peridotites (dunite, &c.) of North Carolina (Abstr., 1898, ii, 603; this vol., ii, 494). Morozewicz's recent experiments (this vol., ii, 762) were made on magmas containing alkalis and alkaline earths, but his earlier experiments (Abstr., 1895, ii, 275) showed that alumina readily dissolves in a magma having the composition of a basic magnesian rock, and that it separates out again as corundum and spinel. The conditions for the separation of corundum from such magmas are summarised as follows.

In a magnesium silicate magma containing no excess of magnesia, all the alumina separates out as corundum; but when there is an excess of magnesia, this unites with a portion of the alumina to form spinel, and the remainder of the alumina separates as corundum. When chromic oxide is present, any small amounts of alumina and excess of magnesia in the magma may enter into the composition of the chromite (mitchellite, this vol., ii, 495). In a peridotite magma containing, besides alumina, oxides of the alkalis and alkaline earths, a portion of the alumina is used to unite with these oxides and silica to form felspar. L. J. S.

Emery from Virginia. By W. W. Miller, jun. (*Amer. Chem. J.*, 1899, **22**, 212—213).—Analysis of emery from near Whittle's, Pittsylvania Co., gave

Al_2O_3.	Fe_2O_3.	FeO.	SiO_2.	TiO_2.	Na_2O.	Total.
56·74	15·50	20·77	0·68	1·86	3·95	99·50

It forms a black, crystalline mass, magnetic; polar; sp. gr. 4·205; H on edges 8; infusible, and does not lose in weight on ignition. Omitting the silica, titanic oxide, and soda, the composition corresponds with a mixture of 22·48 per cent. of magnetite, 33·34 per cent. of hercynite, and 37·16 per cent. of corundum. The erosive power is not sufficient to give it value as emery. W. A. D.

The so-called Valleriite. By Jakob Petrén (*Jahrb. f. Min.*, 1899, ii, Ref., 17—18; from *Geol. För. Förh.*, 1898, **20**, 183—192).—Valleriite was the name given by Blomstrand in 1870 to a mineral substance from Nya Kopparberg, Sweden, which, according to his analyses, had the composition $2CuS,Fe_2S_3 + 2MgO,Fe_2O_3 + 4H_2O$. A chemical and microscopical examination of the material shows it to be a mixture of covellite, pyrrhotite and spinel, together with hydrotalcite, chalybite, and limonite as secondary products. The covellite (CuS) separated from the mixture has the composition, Cu, 62·35; S, 34·83; Fe, 2·37 = 99·55 per cent. The separated spinel has the following composition:

Al_2O_3.	Fe_2O_3.	FeO.	MgO.	Total.
67·75	2·88	0·86	27·04	98·53

L. J. S.

Formation of Oceanic Salt Deposits, particularly of the Stassfurt Beds. XII. Hydrate of Magnesium Sulphate, $MgSO_4 + \frac{5}{4}H_2O$. By Jacobus H. van't Hoff and H. M. Dawson (*Chem. Centr.*, 1899, i, 1137—1138; from *Sitzungsber. Akad. Wiss. Berlin*, 1899, 340—343).—When a solution of magnesium sulphate containing magnesium chloride is concentrated at 65°, the dihydrate, $MgSO_4 + 2H_2O$, separates in cauliflower-like bundles of slender needles which soon change to more transparent and crystalline masses of the composition $MgSO_4 + \frac{5}{4}H_2O$. Experiments with the dilatometer showed that the same *hydrate*, $MgSO_4 + \frac{5}{4}H_2O$, may be obtained by adding a crystal of it to a solution of magnesium sulphate containing magnesium chloride which has deposited all its tetrahydrate at 25°. This hydrate also separates spontaneously when the solution is very slowly concentrated. E. W. W.

Minerals of Sarrabus, Sardinia. By G. B. Traverso (*Jahrb. f. Min.*, 1899, ii, Ref., 218—221; from *Sarrabus e suoi minerali*, Alba, Piedmont, 1898).—Descriptions are given of the numerous mineral species occurring in the mineral veins of Sarrabus; analyses are given of the following:

Embolite contains 61·1 AgCl and 29·4 AgBr. Native silver gave the results under I; also traces of lead and zinc. Massive argentite gave II.

Ullmannite gave analysis III, by Mascazzini; also impurities 9·736 per cent.

	Ag.	Cu.	As.	Sb.	S.	Hg.	Ni.	Co.	AgCl.
I.	91·07	0·26	0·12	0·07	0·28	0·03	trace	—	0·87
II.	83·0	1·2	—	0·9	12·0	trace	0·4		—
III.	0·1	—	0·78	52·51	13·37	—	24·0	—	—

Partial analyses are also given of impure arsenic and antimony compounds of nickel and cobalt. L. J. S.

Occurrence of Iodine in Cuprite and in Malachite. By Wilhelm Autenrieth (*Chem. Zeit.*, 1899, **23**, 626. Compare Abstr., 1897, ii, 561).—A number of specimens of cuprite and malachite from New South Wales have been found to contain small quantities of iodine, the amount varying from 0·006—0·15 per cent. It is thought probable that the iodine is present in cuprite in the form of cuprous iodide (marshite) and in malachite as a basic cupric iodide, OH·CuI.
J. J. S.

Occurrence of Iodine in Cuprite and in Malachite. By Carl Ochsenius (*Chem. Zeit.*, 1899, **23**, 669. Compare preceding abstract).—The author draws attention to the conversion of sulphide ores into halogenised ores in the Andes of both North and South America. In Chili, chlorides occur in the upper, iodides in the lower, and bromides in the intermediate layers. J. J. S.

Iodine in Copper Ores from New South Wales. By Arthur Dieseldorff (*Zeit. prakt. Geol.*, 1899, 321—322).—Copper ores—cuprite, malachite and chrysocolla—from several localities, Cobar, Broken Hill, &c.—were found to contain small amounts of iodine, from 0·01 to 0·14 per cent., together with a little silver. The occurrence of iodyrite (AgI) and marshite (CuI) at Broken Hill suggests that the iodine is present as iodides of silver and copper.
L. J. S.

Formation of Manganosite and Periclase By Hjalmar Sjögren (*Jahrb. f. Min.*, 1899, ii, Ref., 15—16; from *Geol. För. Förh.*, 1898, **20**, 25—32. Compare Abstr., 1897, ii, 324).—Manganosite (MnO) and periclase (MgO) occur under the same conditions as original constituents in dolomitic limestone at Långban and at Nordmark, Sweden. The methods successful in the artificial production of these minerals are, on account of the high temperature employed, not in accordance with those which must have occurred in their natural formation. Analysis by R. Mauzelius of the pure dolomitic limestone, which is the matrix of periclase, gave

Insol.	SiO_2.	Fe_2O_3.	MnO.	CaO.	MgO.	CO_2.	Total.
1·26	0·18	0·08	6·38	30·62	16·21	[45·27]	100·00.

The dolomitic matrix of manganosite contains more manganese and less magnesium than shown in this analysis.

Since alkali carbonates precipitate both hydroxides and carbonates from cold dilute solutions of magnesium and manganese salts, the hydroxides could have been deposited at the same time as the dolomite; these hydroxides are now partly represented by original brucite, $Mg(OH)_2$, and pyrochroite, $Mn(OH)_2$, and partly by the periclase and manganosite, the dehydration probably taking place at the same time that the limestone became crystalline. Secondary brucite and pyrochroite, derived by the subsequent alteration of the periclase and manganosite respectively, also occur in the dolomitic limestone.

L. J. S.

Smithsonite from Arkansas. By W. W. Miller, jun. (*Amer. Chem. J.*, 1899, **22**, 218—219).—Smithsonite, from the "Morning Star" mine, Searcy Co., Arkansas, gave on analysis,

ZnO.	CdO.	CuO.	FeO.	CO_2.	SiO_2.	Total.
63·67	1·06	0·21	0·07	34·69	0·52	100·22

It occurs in botryoidal form and encloses zinc blende in layers 6—8 mm. thick. It is greyish-white in colour with a pearly lustre, translucent, H = 5, sp. gr. 4·179.

W. A. D.

Manganese Silico-carbonates from Hautes-Pyrénées. By Hermann Lienau (*Chem. Zeit.*, 1899, **23**, 418—419).—*Viellaurite* is the name given to a massive, dark-grey mineral with granular structure from the Coustou mine near Vielle-Aure in Hautes-Pyrénées. On exposure to the air, it becomes black. The powder is almost white, and is completely decomposed by acids with separation of gelatinous silica. The mean results of the analyses are given under I; formula, $5MnCO_3,2Mn_2SiO_4$.

	SiO_2.	CO_2.	MnO.	FeO.	CaO.	MgO.	Al_2O_3.	S.	H_2O.	Total.	Sp. gr.
I.	11·93	21·09	63·01	1·56	1·06	0·77	—	0·55	—	99·97	3·7
II.	19·24	15·00	48·65	0·96	8·15	1·18	3·65	—	3·16	99·99	3·62

Torrensite is named from the Torrens mine near Ville-Aure, where the mineral occurs with rhodonite and friedelite. It is compact, and light sepia to reddish-grey, becoming brown on exposure to the air; the powder is pale greyish-rose, and is easily decomposed by acids. The mean (II) of two analyses gives the formula $MnSiO_3,MnCO_3,\frac{1}{2}H_2O$.

Homogeneous minerals containing both silicic and carbonic acids are of rare occurrence; thaumasite and cancrinite are examples.

L. J. S.

Deposition of Barium Sulphate as a Cementing Material of Sandstone. By Frank Clowes (*Proc. Roy. Soc.*, 1899, **64**, 374—377).—Some years ago, a certain sandstone occurring near Nottingham was found to contain 33—50 per cent. of barium sulphate, which evidently served to cement the sand grains together. The existence of the barium sulphate has now been explained by the discovery that the water from an artesian boring in the district contains barium chloride (White, this vol., ii, 420). This fact, together with the proximity of calcium sulphate veins, accounts for the peculiarly local occurrence of the sandstone referred to. J. C. P.

Quenstedtite from Iowa. By Otto Kuntze (*Amer. Geologist*, 1899, **23**, 119—121).—In the dry season of the year, the sandstone walls beneath the overhanging ledges on the banks of a small creek near Montpelier, Muscatine Co., are encrusted with a sulphur-yellow material 1—2 inches in thickness. It is readily soluble in cold water, and effloresces on long exposure to the air. Sp. gr. 2·212 ; $H = 2\frac{1}{2}$. The mean of two analyses is,

SO_3.	Al_2O_3.	Fe_2O_3.	Insol. (SiO_2).	H_2O.	Total.
39·01	0·27	26·86	1·79	32·32	100·25

This agrees approximately with the formula of quenstedtite, namely, $Fe_2(SO_4)_3 + 10H_2O$. At 105°, there is a loss of 21·04 per cent., gradually increasing to 29·94 per cent. at 140°. The substance has been derived by the oxidation of pyrites, numerous specks of which occur in the sandstone. Such substances are of comparatively rare occurrence, and are only formed under favourable conditions.

L. J. S.

Formation of Minerals in Magmas. By József Morozewicz (*Tsch. Min. Mitth.*, 1898, **18**, 1—90, 105—240).—The numerous experiments were made on large amounts (up to 1 cwt. or more) of material heated in fire-clay crucibles in a Siemens' furnace. After fusion of the material in the hottest part (1600°) of the furnace, the crucibles were moved to successively cooler places (down to 500°), allowing the magmas to cool and crystallise slowly for several weeks or months. The materials used were rocks, or mixtures of minerals or pure chemicals, of known composition. Numerous (54) analyses were made of the resulting rocks and crystallised minerals.

Formation of Corundum, Spinel, Sillimanite and Cordierite in Silicate-magmas (compare Abstr., 1895, ii, 275).—In attempts to produce certain types of volcanic rocks, some of the resulting crystalline masses were found to contain much corundum and spinel, and this led the author to determine the chemical conditions under which these minerals were formed. In these cases, the magmas were all rich in alumina, and in the crystalline products the corundum and spinel were set in a ground-mass, consisting of olivine, magnetite, nepheline, anorthite and glass, with sometimes melilite, augite, hypersthene and labradorite. The corundum crystals are tabular in habit and reach a diameter of 1·5 mm. ; the various colours—blue, red, yellow—may be explained by the presence of oxides of iron. The material contains 99·5—99·8 per cent. of alumina ; sp. gr. 4·03. The spinel octahedra are colourless, yellow, green, or black, depending on the amount of iron ; in five analyses, the composition varies from $13MgAl_2O_4,MgFe_2O_4$ to $MgAl_2O_4,4FeAl_2O_4$, &c.

After isolating the corundum and spinel by means of hydrofluoric and sulphuric acids, analyses of the ground-mass showed that in all cases the ratio of $Al : M(=K_2, Na_2, Ca)$ is unity ; the excess of alumina over this amount in the original magma has separated as corundum, or as corundum and spinel when magnesia and iron oxides are also present. Magmas of the composition $MO,Al_2O_3,2SiO_2$ (anorthite) and $MO,Al_2O_3,6SiO_2$ (albite), are therefore capable of dissolving excess of alumina, which crystallises out on cooling in the form of corundum. An anorthite magma dissolves about 5 per cent. of alumina (in the form of bauxite), and a nepheline magma about

29·5 per cent., whilst in an orthoclase magma it is almost insoluble. Excess of silica and alumina in an albite magma crystallises out as sillimanite, in colourless prisms, and corundum. Corundum also crystallises from sodium aluminate containing an excess of alumina; hence the formation of corundum is not connected with the acidity or basicity of the magma. From an andesitic magma with $MO:MgO:Al_2O_3:SiO_2 = 1:0·9:1·25:7$, there was a separation of cordierite and spinel with labradorite, augite, magnetite and glass, and the product closely resembled the cordierite-vitrophyrite from South Africa described by Molengraaff.

The conditions for the separation of these minerals are summarised as follows: In supersaturated alumino-silicate magmas of the general composition $MO,mAl_2O_3,nSiO_2$ ($n =$ or > 2), the whole of the excess of alumina $(m - 1)$ separates out: (*a*) as corundum if no magnesia or ferrous oxide is present, and if $n < 6$; (*b*) as sillimanite, or sillimanite and corundum, if $n > 6$. When the magmas are rich in magnesia and ferrous oxide, the excess of alumina separates out: (*c*) as spinel, or spinel and corundum, if $n < 6$; and (*d*) as cordierite, or cordierite and one or more of the other minerals, if $n > 6$.

Natural magmas containing an excess of alumina are of comparatively rare occurrence: descriptions and analyses are given of some rocks of this type occurring as veins in the granites, &c., of the Ilmen Mountains, Urals. *Kyschtymite* is the name given to a corundum-anorthite rock from the Kyschtym district; it contains 50—60 per cent. of corundum and some spinel. Corundum-pegmatite and corundum-syenite from the same region consist respectively of corundum and orthoclase, and of corundum, orthoclase and biotite; in both cases, the orthoclase (microperthite) contains a considerable amount of soda. Such magmas containing an excess of alumina crystallising out as corundum are analogous to magmas containing an excess of silica, which crystallises out as quartz, and on this is based a classification of rocks. In other cases, where a separation of corundum, spinel, sillimanite and cordierite has taken place, there has been an absorption by the magmas of clay-slate at the contacts.

Composition of Pyroxene from Silicate-fusions.—Analysis I is of colourless crystals of enstatite, isolated from a magma having the composition of a basalt rich in magnesia. II (contains also a trace of TiO_2) of augite crystals 1·5 mm. long, from a magma having the composition of a melilite-basalt. III (contains also MnO, 4·08 per cent.) of reddish-brown, prismatic crystals of augite from a fusion containing also haüyne, anorthite and magnetite; it contains, as shown by the analysis, 73 per cent. of Tschermak's hypothetical molecule, MR_2SiO_6, and it is more readily decomposed by hydrochloric acid than other pyroxenes. IV and V of alkali-augite, forming spherulites in quickly cooled basalt magmas.

	SiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	CaO.	MgO.	K_2O.	Na_2O.	Total.	Sp. gr.	Extinction on (010).
I.	53·07	4·12	6·08	0·94	2·85	33·75	—	—	100·81	3·087	0°
II.	46·93	6·76	10·82	0·70	20·00	12·70	trace	1·72	99·63	3·177	45
III.	30·87	13·82	25·35	1·12	22·17	1·54	0·43	1·51	100·89	$>$3·18	8
IV.	53·72	7·87	7·19	5·17	8·70	5·73	1·10	10·03	99·51	2·886	18
V.	58·91	10·81	7·12	1·86	10·12	4·34	1·00	4·98	99·14	2·724	10

All these pyroxenes can be expressed as isomorphous mixtures of three silicates; the metasilicate $M''SiO_3$, Tschermak's hypothetical molecule $M''R'''_2SiO_6$, and the ægirite-jadeite molecule $M''R'''_2Si_4O_{12}$. The optical characters vary with the composition, the angle of extinction on $b(010)$ decreasing with an increase in the amount of MR_2SiO_6 and $MR_2Si_4O_{12}$; the pure compound, MR_2SiO_6, would be expected to be orthorhombic.

In magmas rich in silica (>50 per cent.) and alkalis, the ægirite-jadeite molecule combines with the metasilicate, whilst in more basic magmas Tschermak's molecule takes its place. In magmas with about 50 per cent. of silica and poor in alkalis, orthorhombic pyroxenes separate when $(MgO + FeO) : CaO$ equals or exceeds $3:1$, whilst monoclinic pyroxene separates when this ratio is less than $3:1$.

Wollastonite, in white, acicular crystals several cm. long, was found in the lower layers of ordinary glass, which had remained for a considerable length of time in contact with the hearth of the furnace, and were richer in lime than the upper layers. The crystals are elongated parallel to the axis of symmetry; analysis gave the formula $CaSiO_3$; sp. gr. 2·8075.

Synthesis of Nosean, Haüyne, Sodalite and Lagoriolite (compare Abstr., 1893, ii, 19, 422).—Nosean, as white, grey, or blue isotropic dodecahedra and rounded grains, was formed when mixtures of kaolin and soda, or of kaolin, calcium carbonate and gypsum, were fused at a red heat (600°) for several days with excess of sodium sulphate. Five analyses of the material give the formula $3(Na_2Al_2Si_2O_8) + Na_2SO_4$, with, in some cases, a little sodium replaced by calcium; this formula also expresses the composition of natural nosean better than the usually accepted formulæ $2(Na_2Al_2Si_2O_8) + Na_2SO_4$, and $3(Na_2Al_2Si_2O_8) + 2Na_2SO_4$. The blue colour of the crystals is due to the presence of sulphides, probably iron sulphide.

Haüyne was not formed by fusing mixtures of the composition of haüyne with sodium sulphate. It was produced together with augite (anal. III. above) in a magma having the composition of haüyne-basalt.

Sodalite in white dodecahedra or grains was formed when kaolin or nepheline was fused with soda and excess of sodium chloride. Analyses give the formulæ $2(Na_2Al_2Si_2O_8) + NaCl$ and $3(Na_2Al_2Si_2O_8) + 2NaCl$, both of which agree with natural sodalites.

Lagoriolite (soda-garnet) is the name given to a new product obtained by fusing at a dark red-heat mixtures of silicic acid and hydrargillite, $Al(OH)_3$, with sodium and calcium sulphates and carbonates. The square plates are flattened cubes which are either isotropic or birefringent with twin lamellæ. Analyses give the formula $3(Na_2,Ca)O,Al_2O_3,3SiO_2$ with $Na_2O : CaO = 3:2$; in one analysis, there is only a trace of calcium, and in all there are small quantities of sulphuric anhydride. This is the garnet formula, and the substance forms a connecting link between the garnet and the nosean groups. The largest amount of alkali yet found in natural garnet is 4·22 per cent. in melanite from the phonolite of Oberschaffhausen.

Liparite magmas.—Acid magmas do not readily crystallise, and as a rule they solidify to a glass. When, however, the experimental magmas have crystallised, the excess of silica has separated as tridymite, or in a prismatic modification the characters of which are as yet unknown. A liparite magma, fused with 1 per cent. of tungstic acid, gave crystals of quartz, biotite and sanidine proving that the essential constituents of granite can be formed by dry fusion.

A list of minerals which have been formed artificially by the author includes all the important rock-forming minerals except hornblende, and the crystallised fusions represent almost all the known typet of alumino-silicate rocks. The structure of these artificial rocks depends on the chemical composition of the magma and on the rate of cooling. The order in which the various minerals separate from the magmas is discussed; it does not depend, as has been stated, on the fusibility or basicity of the minerals, but on their solubility and the relative amounts in which they are present in the solution. Several cases are noticed in which there has been a differentiation in the artificial magmas, as shown by a separation into layers of different chemical composition and specific gravity.

Incidentally, the following analyses are given of material used in the experiments: A, (by F. Dutkowski), of kaolin from Schneeberg; B. nepheline, from Låven, Norway.

	SiO_2.	Al_2O_3.	Fe_2O_3.	CaO.	K_2O.	Na_2O.	H_2O.	Total.
A.	45·75	40·17		0·20	—	—	13·98	100·10
B.	44·51	33·38	—	0·45	5·50	15·69	1·37	100·90.

L. J. S.

Asbestos. By Paul Kersting (*Chem. Centr.*, 1898, ii, 125; from *Chem. Ind.*, **21**, 171—174).—The best commercial asbestos is from North Italy; Canadian and South African are now coming into use. Analyses I and II are of Canadian [chrysotile], and III of blue South African [crocidolite]. For I and II, the formula is given as $MgSiO_3,Mg_2SiO_4 + 2H_2O$, and for III, $(Mg,Fe)SiO_3 + H_2O$. When treated with hydrochloric acid, there is dissolved 41·24 per cent. of I, 37·48 of II, and 12·62 of III. The South African is softer and finer than the Canadian, but it is less refractory and falls to pieces when ignited.

	SiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	CaO.	MgO.	K_2O.	Na_2O.	P_2O_5.	SO_3.	H_2O.	Total.
I.	39·04	trace	0·25	2·10	0·51	42·57	0·09	0·22	—	0·10	15·20	100·08
II.	41·56	3.42	0·41	6·67	0·83	33·38	0·11	0·30	—	0·08	13·15	99·91
III.	43·61	0·21	16·57	12·15	0·89	7·02	3·06	2·14	0·06	0·06	14·30	100·07

L. J. S.

Thalite and Bowlingite from Lake Superior. By Newton H. Winchell (*Amer. Geologist*, 1899, **23**, 41—44).—Thalite was described in 1852 as occurring in cavities in trap at several places on the north shore of Lake Superior. It is soft with a soapy feel, and is dirty white or grey; it is easily gelatinised by hydrochloric acid. Sp. gr. 2·20. Thin sections show a confused vermicular aggregate, sometimes with bands formed of minute transverse fibres; the fibres show a positive bisectrix parallel to their length with a small axial angle. Analysis by L. B. Pease gave,

SiO_2.	Al_2O_3.	Fe_2O_3.	MgO.	CaO.	K_2O.	Na_2O.	H_2O.	Total.
42·38	7·37	2·65	23·29	5·52	0·19	0·36	18·18	99·94

At 100°, there is a loss of 10·38 per cent.

Pseudomorphs after olivine occurring in the same rocks are supposed to be bowlingite; the optical characters of this are described.

L. J. S.

Thalénite, a new Mineral. By Carl Benedicks (*Geol. För. Förh.*, 1898, **20**, 308—312; and *Bull. Geol. Inst. Univ. Upsala*, 1899, **4** (1898), 1—15).—The new mineral occurs, massive and in crystals, with fluocerite, gadolinite and allanite in quartz at Österby in Dalecarlia, Sweden. It is flesh-red and translucent, with a greasy lustre. Fracture uneven to splintery; brittle; no cleavage; H = $6\frac{1}{2}$. Approximate measurements of the dull, monoclinic crystals gave [$a : b : c$ = 1·154 : 1 : 0·602; $\beta = 80\frac{1}{5}°$]. Optically negative, axial plane ⊥ b(010), $\beta\chi_a$ nearly ⊥ a(100), 2V = 67° 35′, α = 1·7312, β = 1·7375, γ = 1·7436 (Na). The material is easily decomposed, with separation of gelatinous silica, by dilute hydrochloric acid. The mean of five partial analyses made on fresh, transparent material of sp. gr. 4·227 is given under I; formula, $H_2O,2Y_2O_3,4SiO_2$. The molecular weight of the yttrium earths is 245·3; the absorption spectrum of the nitrates shows the presence of erbium, holmium and didymium. The gas liberated when the mineral is heated or treated with acids was examined spectroscopically and found to contain nitrogen and helium.

	SiO_2.	Y_2O_3.	Fe_2O_3.	Al_2O_3.	BeO.	CaO.	MgO.	Na_2O.	SnO.	H_2O.	CO_2.	Gas.	Total.
I.	29·88	63·35	0·30	0·45		0·49	0·21	0·26	0·23	2·08	1·04	1·40	99·69
II.	27·69	58·58	1·51	0·35		2·19	0·40	1·07	0·22	2·70	3·32	2·50	100·53
III.	30·89	63·91	0·25 ?		—	0·37	0·10	0·36	0·19?	1·54	Nil	1·96	99·57

Analysis II is of weathered thalénite; this is lighter in colour and softer; sp. gr. 3·945. Some organic matter is present, and to this the colour of the mineral is probably due.

Minerals allied to thalénite are yttrialite, rowlandite, and kainosite. There are also analogies in the chemical formulæ and crystal angles of thalénite and laumontite.

In an appendix to the second paper, new material is described. This is yellow in colour. It is more transparent, has a stronger lustre and weaker birefringence; μ = 1·713, sp. gr. 4·11—4·16; fracture conchoidal. Analysis III shows it to be a purer form of thalénite. The molecular weight of the yttrium earths is 246·2.

L. J. S.

[Analyses of Felspars.] By Franz Loewinson-Lessing (*Jahrb. f. Min.*, 1899, ii, Ref. 232—238; from *Travaux Soc. des Nat. St. Pétersbourg*, 1898, **26**, livr. 5, 404 + xl. pp. (Russ.) + 7 pp. Résumé (French).—The following analyses of felspars are given in a petrographical paper dealing generally with a chemical classification of rocks, and on the eruptive rocks of a portion of the Central Caucasus: numerous analyses of rocks are also given.

I, partly pelitised felspar from porphyritoid; II, albite from an adinole; III, pelitised felspar; IV, felspar in porphyrite from the Basboika River, Urals; V—VII, pelitised felspar; VIII, felspar in gabbro from Höllmühle, near Penig; IX, in gabbro-diorite from Kühler Grund, near Eberstadt; X, in gabbro from Thalhorn, Vosges; XI, orthoclase from Baveno granite:

	SiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	CaO.	MgO.	K_2O.	Na_2O.	Loss on ignition.	Total.
I.	50·09	29·64	—	—	14·09	1·11	—	—	5·43	100·36
II.	64·18	21·37	—	—	—	—	—	11·30	0·45	97·30
III.	52·00	22·95	0·21	0·47	18·50	0·44	0·42	2·40	3·24	100·63
IV.	50·86	24·71	0·95	1·56	9·20	0·48	2·80	4·12	5·41	100·09
V.	45·11	28·58	1·28	—	18·24	1·27	0·30	2·52	2·97	100·27
VI.	48·15	32·38	—	—	16·09	0·47	0·38	2·13	1·18	100·78
VII.	59·60	23·66	—	—	4·57	—	6·21	3·72	1·80	99·56
VIII.	50·52	31·37	—	—	13·25	—	—	4·13	0·55	99·82
IX.	53·78	31·19	—	—	8·02	0·37	0·84	5·00	0·88	100·08
X.	53·22	29·85	—	—	4·53	1·30	3·33	4·70	2·96	98·89
XI.	67·66	18·73	—	—	—	—	8·43	3·75	0·67	99·24

In several so-called "kaolinised" plagioclases, it is shown that the alteration product is not kaolin, but a mixture of various hydrated silicates of aluminium and magnesium, zeolites, &c.; for this mode of alteration of felspar the term pelitisation is proposed. L. J. S.

Constitution of Tourmaline. By Frank W. Clarke (*Amer. J. Sci.*, 1899, [iv], **8**, 111—121).—The author argues in favour of the formula of tourmaline, $2[Al(SiO_4)_3R'''_2(Al{\cdot}BO_2)]:Al(BO_3)R'_2$, proposed by him (Abstr., 1897, ii, 52), as opposed to the formula recently given by Penfield and Foote, namely, $(H,R', \&c.)_9Al_3(B{\cdot}OH)_2Si_4O_{19}$ (this vol., ii, 304). Reducing both formulæ to the ultimate acids, they become respectively $H_{29}B_3Si_6O_{31}$ and $H_{30}B_3Si_6O_{31\frac{1}{2}}$. The small difference between these formulæ hardly amounts to more than the uncertainties of the analyses. Clarke's formula expresses the relation between the micas and tourmaline, and it is shown to agree closely with several of Riggs' analyses. Analyses from which Penfield and Foote's formula may be deduced may also be made to agree with Clarke's formula by assuming the presence of the basic divalent group $Al{\cdot}OH$ or AlF, and by replacing some Ca by NaH; and the few analyses in which boric acid is low may be explained by partial replacement of $Al{\cdot}BO_2$ by $Al{\cdot}OH$ and AlF. [Clarke's acid, $H_{29}B_3Si_6O_{31}$, is identical with that recently deduced by Rheineck (this vol., ii, 601).]
L. J. S.

Composition of Moldavite. By Conrad H. von John (*Verh. k.k. geol. Reichs.*, 1899, 179—182. Compare Abstr., 1896, ii, 434).—F. E. Suess (*Verh. k.k. geol. Reichs.*, 1898, 387; *Anzeiger Akad. Wiss. Wien*, 1898, No. XXIV.) has recently given reasons, mainly based on the peculiar surface markings, for considering moldavites to be of cosmic origin, and he concludes that they represent a hitherto unrecognised type of aerolites. The following analyses are given of the material examined by Suess: I, moldavite from Budweis in Bohemia; II and III, from Trebitsch in Moravia.

	SiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	MnO.	CaO.	MgO.	K_2O.	Na_2O.	H_2O.	Total.
I.	82·68	9·56	—	1·13	0·18	2·06	1·52	2·28	0·63	—	100·04
II.	78·61	12·01	0·16	3·09	0·11	1·62	1·39	3·06	0·44	—	100·49
III.	77·96	12·20	0·14	3·36	0·10	1·94	1·48	2·70	0·61	—	100·49
IV.	52·32	0·30	—	1·20	1·02	17·52	3·60	22·84	0·24	0·80	99·84

Analysis IV is of material from Netin, Moravia, which was considered by Suess to be an artificial glass since it differed from true moldavite in colour and the characteristic surface markings; the analysis also shows it to be quite distinct. Nine earlier analyses of moldavite are quoted, and there is seen to be very little variation in composition. L. J. S.

Riebeckite and Ægirine in Granite from Turcoaia, Roumania. By L. Mrazec (*Bull. Soc. Sci. Bucarest*, 1899, **8**, 106—111).—A grey, medium-grained granite extensively quarried at Mt. Jacob Deal, near Turcoaia, in the district of Dobrogea [Dobrudscha], contains magnetite, allanite?, zircon, ægirine, riebeckite, albite, anorthoclase, orthoclase, quartz, hæmatite, limonite, epidote and chlorite. The riebeckite occurs as black prisms sometimes 2 cm. long; it is strongly pleochroic, and the angle of optical extinction on (010) is 5°. Chlorite and limonite are formed by its alteration. Analysis of impure material gave,

SiO_2.	Al_2O_3,ZrO_2.	Fe_2O_3.	FeO.	MnO.	CaO.	MgO.	Na_2O.	K_2O.	H_2O.	Total.
[45·69]	7·01	14·33	17·62	3·24	4·28	1·77	4·62	0·99	0·45	100·00

L. J. S.

Alteration Products of Magnesia-mica; Variation of the Optical Characters with the Composition. By Eberhard Zschimmer (*Jahrb. f. Min.*, 1899, ii, Ref. 210—214; from *Inaug.-Diss. Jena*, 1898).—The following analyses are given of lepidomelane, in various stages of alteration, from the granite of the Schneidemüllerskopf, near Ilmenau, in Thuringia; optical determinations are also given. The fresh mica has the composition of lepidomelane, and all the altered forms can be expressed as mixtures of Tschermak's two molecules, $H_2K(Al,Fe)_3Si_3O_{12}$ and $Mg_6Si_3O_{12}$.

SiO_2.	TiO_2.	Al_2O_3.	Fe_2O_3.	MgO.	CaO.	FeO.	K_2O.	Na_2O.	H_2O.	Total.	Sp. gr.
32·75	1·85	14·79	23·53	10·25	3·09	5·35	4·30	—	3·79	99·70	3·09
35·38	0·81	15·63	16·27	12·30	1·59	8·06	5·34	0·22	5·38	100·98	3·00
35·69	0·14	17·85	18·62	11·83	2·22	4·64	3·27	0·39	5·82	100·47	2·94
33·93	1·23	16·02	17·75	13·53	1·85	3·68	3·29	—	7·80	99·08	2·85
35·88	1·25	18·88	14·97	13·66	1·34	3·69	2·25	—	7·73	99·65	2·82
36·87	1·61	21·21	11·97	12·34	1·78	3·63	2·36	—	7·64	99·41	2·78

With progressive alteration (or "bleaching") there is a separation of iron as ferric oxide, and a replacement of potash by water; at the same time, the specific gravity, pleochroism, and indices of refraction decrease, whilst the optic axial angle increases.

A connection is traced between the optic axial angle of various micas and the chemical composition. The position of the optic axial plane in the two classes of micas does not depend on the chemical composition, but is possibly connected with a kind of dimorphism.

L. J. S.

Sandstone from Augusta Co., Virginia. By W. W. Miller, jun. (*Amer. Chem. J.*, 1899, **22**, 216—217).—The sandstone, which consists of angular fragments interspersed with small seams of clay, possesses the peculiar property of becoming firm and compact when it is laid and beaten down for a pathway and left undisturbed. Analysis gave

	SiO_2 (amorphous, free.)	SiO_2 (combined.)	Al_2O_3.	TiO_2.	Fe_2O_3.	MgO.	K_2O.	Na_2O.	H_2O at 100°.	H_2O by ignition.	Total.
Clay...	0·53	63·68	24·23	0·94	3·57	1·25	4·04	0·77	0·49	4·83	99·29
Rock..	0·00	96·72	2·37	0·00	0·46	0·00	0·00	0·19	0·00	0·26	100·00

These results do not explain the peculiar packing power of the material, which must, therefore, be attributed to physical causes. W. A. D.

The Parent-rock of the Diamond in South Africa. By Thomas George Bonney (*Proc. Roy. Soc.*, 1899, **65**, 223—236).—In the "blue ground" of the Newlands mines, West Griqualand, about 40 miles N.W. of Kimberley, are rounded boulders of eclogite (a holocrystalline, igneous rock composed of garnet and diopside), which occasionally contains colourless octahedra of diamond apparently as an original constituent. It has long been recognised that the diamonds have not been formed *in situ* in the "blue ground," but until now the only mineral found intimately associated with them is garnet. The water-worn character of the eclogite boulders proves that the "blue ground" is not of igneous origin, but a true breccia produced by the destruction of various rocks, including the eclogite which has contributed the diamonds to the mixture. L. J. S.

Rhyolites of the Hauraki Goldfields, New Zealand. By James Park and Frank Rutley, with Analyses by Philip Holland (*Quart. Journ. Geol. Soc.*, 1899, **55**, 449—469).—A geological and petrographical description is given of the Pliocene rhyolites of the Hauraki goldfields. The gold-bearing rocks are andesites. Analysis I is of a pale lithoidal rock from Omahu, consisting almost exclusively of small spherulites with some quartz, sanidine and oligoclase. II is of a pale greyish-white or yellowish rhyolite from Waihi, with numerous minute crystals of oligoclase and andesine, with some sanidine and labradorite:

	SiO_2.	TiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	CaO.	BaO.	MgO.	K_2O.	Na_2O.	SO_3.	H_2O.	Total.	Sp. gr.
I.	77·59	0·63	12·75	0·67	Nil	0·04	0·10	0·16	3·99	2·56	0·07	1·54	100·10	2·511
II.	73·08	0·62	13·50	2·60	0·13	1·07	0·06	0·15	3·19	3·95	0·12	1·33	99·80	2·514

Also traces of MnO and P_2O_5. L. J. S.

Clay from Russia. By R. Thal (*Jahrb. f. Min.*, 1899, ii, Ref., 210; from *Chem. Zeit.*, 1898, 690).—Thirteen analyses are given of clay from the Gov. Novgorod. L. J. S.

Origin of the Gases Evolved on Heating Mineral Substances, Meteorites, &c. By Morris W. Travers (*Proc. Roy. Soc.*, 1898, **64**, 130—142).—Some minerals containing water, carbonic anhydride, and ferrous oxide give off hydrogen and carbonic oxide when heated, but not when decomposed with dilute sulphuric acid, indicating that the gases are not present in the mineral in the free state. The amount of hydrogen and carbonic oxide liberated on heating is proportional to the quantity of water, carbonic anhydride, and ferrous oxide in the mineral; hence it is probable that these substances interact according to the equations $2FeO + H_2O = Fe_2O_3 + H_2$ and $2FeO + CO_2 = Fe_2O_3 + CO$.

A specimen of Peterhead granite when heated gave off carbonic anhydride, carbonic oxide, and hydrogen, and further investigation showed that the greater part of the carbonic anhydride is derived from the quartz, whilst the hydrogen comes chiefly from the mica and felspar. The carbonic anhydride is probably contained in cavities in the quartz, and the absence of hydrogen in the quartz is against the view that it also is contained in cavities. Analysis showed that the felspar contained both free iron and ferrous oxide.

When heated in a sealed tube with copper sulphate and water, meteoric iron gave only traces of hydrogen and carbonic oxide, whilst a considerable quantity of these gases was evolved when the iron was heated in a vacuum. It thus appears that the gases obtained by heating meteorites are not present as such, but are produced by the interaction of their non-gaseous constituents.

Microscopic examination of minerals which yield helium fails to reveal the presence of cavities, and on certain grounds it is probable that the helium is combined with some constituent of the mineral. The gas is associated with particular minerals, and in some cases the liberation of helium is accompanied by a considerable development of heat. The quantity of helium obtained from cleveite by treatment in an exhausted tube with 30 per cent. sulphuric acid is about double that obtained by merely heating the mineral, and this suggests the possibility of helium being in a state of binary combination, and being evolved according to the equation $XHe_2 = XHe + He$. If the helium were combined with a metal, treatment of the mineral with sulphuric acid would liberate it as a hydride, which would probably be an unstable compound; this may account for the fact that both cleveite and fergusonite yield hydrogen when decomposed with sulphuric acid.

J. C. P.

Meteorite from Mighei, Russia. By **Petr G. Melikoff** and **W. Krschischanowsky** (*Jahrb. f. Min.*, 1899, ii, Ref. 30—31; from *J. Russ. Chem. Soc.*, 1896, **28**, 429, 651—657. Compare Abstr., 1890, 346).—Analyses of this stone, which fell at Mighei, Kherson, in South Russia, on June 18th, 1889, gave I for the portion soluble in water, II for the portion soluble in hydrochloric acid, and III for the insoluble portion.

	SiO_2.	CaO.	MgO.	FeO.	MnO.	Na_2O.	K_2O.	Al_2O_3.
I.	0·03	0·17	0·25	—	—	0·68	0·08	—
II.	24·29	1·85	18·10	22·63	0·55	1·25	0·13	1·38
III.	54·27	4·35	29·68	3·42	1·73	2·02	0·62	4·08

	S.	SO_3.	S_2O_2.	FeS.	Fe.	Ni,Co.	Cl.	org. matter.
I.	—	0·85	0·12	—	—	—	0·04	0·53
II.	3·52			0·46	2·94	1·01	—	—

There is also 1·62 per cent. of chromite, and some amorphous carbon and organic matter. L. J. S.

Meteorite from Zmjenj, Russia. By PETR G. MELIKOFF (*Jahrb. f. Min.*, 1899, ii, Ref., 31—33; *J. Russ. Chem. Soc.*, 1896, **28**, 114, 299—307).—Analysis of the stone which fell at Zmjenj, Minsk, in West Russia, in August, 1858, gave I for the portion soluble in hydrochloric acid and II for the insoluble portion; in I also FeS, 1·32; Fe_2Ni, 0·32; P_2O_5, 0·08.

	SiO_2.	MgO.	CaO.	FeO.	MnO.	Al_2O_3.	K_2O.	Na_2O.	$FeCr_2O_4$.	Total.
I.	9·72	1·20	3·98	1·03	0·41	6·27	0·13	0·56	—	25·02
II.	38·46	15·61	1·86	13·45	1·76	1·79	0·25	1·19	0·56	74·93

The mineralogical composition is: Anorthite, 23·3; bronzite, 74·36; troilite, 1·32; chromite, 0·56; nickel-iron, 0·32 per cent. In the ground-mass of anorthite and bronzite are porphyritic crystals of yellow bronzite with the composition $2MgSiO_3,FeSiO_3$. The crust of the meteorite contains magnetite which has originated by the fusion of the bronzite. L. J. S.

Meteoric Iron from Tombigbee River, Alabama, U.S.A. By WARREN M. FOOTE (*Amer. J. Sci.*, 1899, [iv], **8**, 153—156).—Six masses, weighing in the aggregate 43795 grams, were found between (about) 1859 and 1886 in a north and south line, nine miles in length, near the Tombigbee River in Choctaw and Sumter Counties, Alabama. One of the masses shows minute Widmanstätten figures on the etched surface; another shows schreibersite in large, graphic characters, and the plessite in places presents a glistening, frosted effect. Analysis by J. E. Whitfield of the mass showing the Widmanstätten figures gave

Fe.	Ni.	Co.	P.	C.	S.	Total.
95·02	4·11	0·40	0·324	0·161	trace	100·015.

L. J. S.

Mineral Water from Árva-Polhora, Hungary. By WILHELM KALMANN and MORIZ GLÄSER (*Tsch. Min. Mitth.*, 1899, **18**, 443—446).—Water for the baths at Árva-Polhora, Hungary, is clear and faint yellow; it turns litmus paper violet, and has a faint odour resembling that of iodiform; on long standing in the air, a flocculent, rusty-coloured precipitate is produced. Sp. gr. at 15° = 1·02178. A litre of the water (at 15°) contains the following constituents (in grams): K_2O, 0·15084; Na_2O, 14·74420; Li_2O, 0·14451; CaO, 0·46307; BaO, 0·02746; SrO, 0·12332; MgO, 0·14812; FeO, 0·05603; Cl, 17·66109; Br, 0·11333; I, 0·04109; SO_3, 0·03071; CO_2, 0·23650; P_2O_5, 0·00378; B_2O_3, 0·19382; SiO_2, 0·00865; organic matter, 0·04781; fixed solids, 30·14185. The amounts of some of these constituents differ considerably from those shown in the earlier analysis of this water by C. von Than. L. J. S.

Water of Bagnoli, Tuscany. By RAFFAELE NASINI and ROBERTO SALVADORI (*Gazzetta*, 1899, **29**, ii, 161—180).—This water, which issues at a constant temperature of 21°, is very clear, has a pleasing taste, and is faintly acid to litmus paper. It has a sp. gr. 1·00014 at 12°/4°, its freezing point is $-0{\cdot}007°$, and its electrical conductivity 0·1243 at 25°. When allowed to stand in an open vessel for a long time, a yellowish-white, flocky deposit is obtained, and, on prolonged boiling, beautiful laminæ of gelatinous silica are formed. The water is bacteriologically pure. On analysis, the following results were obtained (grams per litre): Li, 0·000005; K, 0·00382; Na, 0·00935; Mg, 0·004175; Ca, 0·00867; Al, 0·00064; Fe, 0·00041; SO_4, 0·02952; HCO_3, 0·03298; Cl, 0·00776; SiO_2, 0·07336; and TiO_2, 0·000025; total, 0·170745. There are present also traces of rubidium, manganese, strontium, iodine, phosphoric and boric acids, and organic matter. The dissolved gases are 4·10 c.c. of oxygen and 13·16 c.c. of nitrogen per litre; the water has a permanent hardness 5·00, and a temporary hardness 0·33, expressed in French degrees. Its therapeutic and antiseptic properties are probably due to the relatively large amount of silica. T. H. P.

Deposition of Sulphur and Pyrites from Carlsbad Thermal-water. By JOSEF KNETT (*Jahrb. f. Min.*, 1899, ii, 81—84).—The small quantities of sulphur and pyrites deposited from Carlsbad thermal-water have probably originated in the reduction of sulphates by wood. L. J. S.

Mineral Water from the Stanislawa Spring, Galicia. By VON DUNIN-WASOWICZ and J. HOROWITZ (*Chem. Centr.*, 1899, ii, 491; from *Pharm. Post.*, **32**, 295—297, 307—309, 319—320).—The Stanislawa spring is in the Matkow forest, near Karlsdorf. One kilo. of the water contains, in grams: $NaHCO_3$. 2·589612; $FeH_2(CO_3)_2$, 0·024325; $MnH_2(CO_3)_2$, 0·001471; $CaH_2(CO_3)_2$, 0·918375; $BaH_2(CO_3)_2$, 0·097319; $SrH_2(CO_3)_2$, 0·215678; NaCl, 3·497792; KCl, 0·063051; LiCl, 0·004916; NaI, 0·000379; NaBr, 0·000603; $NaNO_3$, 0·000020; Na_2SO_4, 0·075956; SiO_2, 0·043350; CO_2 (free), 2·157232; organic matter, 0·106650. Also traces of copper oxide, nickel oxide, cobalt hydroxide, rubidium chloride, cæsium chloride, ammonium chloride, sodium arsenite, sodium borate, calcium phosphate, and calcium sulphide. L. J. S.

Periodic Analyses of the Rivers of the West Riding of Yorkshire. By EDWARD HALLIWELL (*J. Soc. Chem. Ind.*, 1899, **18**, 348—355).—This is a paper of great local interest, showing the variation in composition and pollution of several streams in Yorkshire. Complete tables are given. L. DE K.

Physiological Chemistry.

Taste in Relation to Chemical Composition. By WILHELM STERNBERG (*Chem. Centr.*, 1899, i, 1216; from *Zeit. Verein. Rübenzuck.-Ind.*, 1899, 376—388).—Whilst the hydrocarbons themselves are colourless and tasteless, derivatives containing oxygen or nitrogen in certain groupings, for instance, as OH- or NH_2-groups, possess both colour, odour, and taste, the last only, however, when these groups are combined with a positive alkyl or a negative carboxyl group respectively. The NO_2-group also confers the property of taste on compounds, and such groups are named "sapiphore." For a compound to have a sweet taste, it must contain at least two oxygen atoms, and every positive group must be united to a negative group, every alkyl group being combined with a hydroxyl group. Thus all polyatomic alcohols taste sweet. The introduction of positive groups, however, changes the sweet to a bitter taste (acetyl compounds of glucose). Aromatic sugars, such as phenyltriose, have a bitter taste. A certain regularity and symmetry of the arrangement of the groups is also a condition of sweetness. In the case of inorganic compounds, the property of a sweet or bitter taste is dependent on certain elements, and these elements the author arranges in a system. E. W. W.

Physiology of Pregnancy. By ALBERT CHARRIN and GUILLEMONAT (*Compt. rend.*, 1899, **128**, 1180—1182).—Inanition in pregnant guinea pigs was compared with that in normal animals. In all cases, a few c.c. of a saline solution were injected daily under the skin. The pregnant animals waste more rapidly, excrete less urine and less urea, develop less heat, are poorer in iron, and offer more marked alterations of structure than the others. W. D. H.

Iron in the Spleen during Pregnancy. By ALBERT CHARRIN (*Compt. rend.*, 1899, **128**, 1614—1615).—The determinations of iron in the spleen confirm the fact, previously recorded by others, that during pregnancy the iron diminishes in that organ, and passes to the fœtus. Microchemical examination confirms this result.

W. D. H.

Influence of the Grape Cure on Human Metabolism. By B. LAQUER (*Chem. Centr.*, 1899, i, 893; from *Centr. inn. Med.*, **20**, 193—203).—During the grape cure, there is proteid-sparing, and in consequence, a putting on of proteid. The aromatic substances contained in grapes which are not too sour produce a lessening of uric acid, and cause it to be separated in a relatively soluble form; this depends on the relationship between the mono- and di-sodium phosphates. Hippuric acid is not markedly influenced, Large quantities (4—5 pounds) of grape juice increase proteid putrefaction, and cause a rise in the ethereal hydrogen sulphates of the urine. W. D. H.

Metabolism in Inanition. By FRIEDRICH N. SCHULZ (*Pflüger's Archiv*, 1899, **76**, 379—410).—During inanition, or when the nutriment given is insufficient, as when carbohydrate alone is given, there is, on the day or two preceding death, an increase in the nitrogen excreted in the urine. This rise, which has been noted by previous observers, is usually accompanied with albuminuria; the nitrogen of the albumin is not, however, sufficient to account for the total increase of nitrogen, but it probably is an indication of the breakdown of the kidney cells. The experiments recorded on rabbits and dogs show that this ante-mortem rise of nitrogen is not a criterion that the animal has reached an absolute minimum of fat, although probably the fat which is left is, in the condition of the animal, not capable of proper utilisation. W. D. H.

Metabolic Experiments with Proteids containing, or not containing, Phosphorus. By H. Zadik (*Pflüger's Archiv*, 1899, **77**, 1—21).—Experiments were carried out on dogs, and the course of their metabolism followed when a proteid containing phosphorus (casein) was given; this was compared with what occurs when a phosphorus-free proteid (edestin) was administered. The animals receiving casein showed that they are able to absorb and assimilate the organic phosphorus, but that the living cells are not able to manufacture phosphorus-holding materials from inorganic phosphates and proteids which are free from phosphorus.

In a further comparison of the two phosphorus-holding proteids, vitellin and casein, it was found that the nitrogenous balance during the administration of the former is the more favourable. W. D. H.

The Course of Peptic Proteolysis Examined Quantitatively. By E. Zunz (*Zeit. physiol. Chem.*, 1899, **28**, 132—173. Compare this vol., ii, 504).—Artificial gastric digestion experiments were carried out with purified proteids such as crystallised egg-albumin and serum-albumin. The digestion was stopped at varying intervals, and the products separated by fractional precipitation with zinc sulphate. The results represented in curves show much the same course in all cases; as the primary products disappear, the secondary products increase. The primary products are acid-albumin, proto- and hetero-proteose, and deutero-proteose *B*. The secondary products are the remaining deutero-proteoses, peptone, and a number of unknown substances which do not give the biuret reaction, as well as ammonia and amido-substances. A portion of these unknown substances must be regarded as primary products. W. D. H.

Metabolism in the Submaxillary Gland. By Yandell Henderson (*Amer. J. Physiol.*, 1899, **3**, 19—25).—In the submaxillary gland, proteid metabolism is more or less distinct from the processes of combustion and liberation of energy; this accords with Heidenbain's hypothesis that the elimination of water and salts, and that of the organic constituents of saliva, are controlled by different mechanisms. On the one hand, in proteid metabolism controlled by *trophic* nerve-fibres, anabolism occurs coincidentally with katabolism, for the nitrogen in the saliva is greater than that lost by the active gland; the gland tends to remain in nitrogenous equilibrium. On the other hand, the processes controlled by the *secretory* nerve-fibres are apparently performed at the expense of a combustion of carbonaceous material stored within the cells during rest, to become the source of heat and secretory work. W. D. H.

Influence of the Removal of the Large Intestine on Metabolism in Dogs. By Vaughan Harley (*Proc. Roy. Soc.*, 1898—1899, **64**, 77—88; 255—307).—In normal dogs, an increase of fat in the food leads to a decrease of urine and urinary nitrogen. After partial removal of the large intestine, the results are similar, except that the fæces are not so greatly increased. Total removal of the large intestine leads to the same effect on the urine, but the nitrogen and fat in the fæces are not influenced; the water in the fæces rises.

Removal of the large intestine does not affect the absorption of carbohydrates, or the breaking up and absorption of fat; but the absorption of proteids is lessened by about 10 per cent. In these animals, large quantities of bile pigment with little or no urobilin are found in the fæces. The alkaline sulphates of the urine are diminished by an increase of fat in the food, but the ethereal hydrogen sulphates are not affected; the same is true for normal dogs. The secretion of the large intestine contains proteids, fats, and salts, but no pigment; the small intestine secretes pigment. W. D. H.

Intestinal Absorption. By E. Waymouth Reid (*Proc. Roy. Soc.*, 1899, **65**, 94—95).—The physiological activity of the intestinal epithelium in absorption is demonstrated by the absorption by an animal of its own serum or plasma under conditions in which filtration, osmosis, and adsorption are excluded; and by the cessation or lessening of the absorption when the epithelium is removed or injured, in spite of the fact that facilities for osmosis and filtration are thereby increased. The chief factor in the absorption of peptone is assimilation (or adsorption) by the cells, whereas in the absorption of sugar, diffusion, variable by the permeability of the cells (and so probably related to their physiological condition), is the main factor. Alcohol stimulates the cells, bile does not. Details are added which show differences in different parts of the intestinal canal. The cells take up organic solids most slowly, then water, then inorganic salts. W. D. H.

Absorption of Iodine Oils. By Robert Rösel (*Pflüger's Archiv*, 1899, **77**, 22—25).—Experiments on human beings show that the iodine of iodised fats is more quickly absorbed than is the iodine from inorganic compounds. In 51—58 hours, from 43 to 79 per cent. of the iodine was recovered in the urine. W. D. H.

Artificial Nutrition of a Normal and of an Atrophic Infant. By Max Rubner and Otto Heubner (*Zeit. Biol.*, 1899, **38**, 315—398).—A lengthy and detailed account of the metabolism and heat formation in two infants brought up by hand; one child was healthy, the other atrophic and feeble. The points of difference are numerous, as would be expected. W. D. H.

Formation of Fat from Proteid in the Cat. By Max Cremer (*Zeit. Biol.*, 1899, **38**, 309—314).—By feeding cats on flesh free from fat and glycogen, carbon is put on in too large a quantity to be accounted for as glycogen. The opinion that it is present as fat is defended in view of Pflüger's criticisms on this point. W. D. H.

The Source of Fœtal Fat. I. By Martin Thiemich (*Chem. Centr.*, 1899, 939; from *Centr. Physiol.*, **12**, 850—852).—The fat of new born children differs considerably in composition. In order to see whether this is due to the mother's diet, one dog during the pregnant period was given a cocoa fat with low iodine number (8), and another linseed oil (iodine number, 120). There was, however, no difference in the composition of the fat of the fœtuses.

W. D. H.

Formation of Sugar in Animals. By **Maneo Kumagawa** and **Rentaro Miura** (*Chem. Centr.*, 1899, i, 299; from *His-Engelmann's Archiv. Physiol. Abth.*, 1898, 431—450).—In starving dogs, injection of phloridzin leads to glycosuria, although such animals had no glycogen and but little fat in their bodies; the sugar must arise from proteid. In another animal, which was fat, the same result followed the injection. The amount of sugar stands in constant relation to the amount of proteid metabolism. W. D. H.

Formation of Sugar from Proteid. By **Rudolf Cohn** (*Zeit. Physiol. Chem.*, 1899, **28**, 211—218).—It is known that aspartic acid and glycocine, when given to animals, increase the amount of liver glycogen; the present experiments on rabbits show that the same is true for leucine. Now leucine is the largest product of proteid decomposition (50 per cent. in the case of casein). It is regarded as probable that leucine is the source of sugar from proteid. A comparison of the formulæ of leucine, $CH_3 \cdot [CH_2]_3 \cdot CH(NH_2) \cdot COOH$, and dextrose, $OH \cdot CH_2 \cdot [CH(OH)]_3 \cdot CH(OH) \cdot COH$ shows this to be by no means impossible. No complicated synthesis is involved; oxidation, splitting off of the amido-group, and reduction are all that are necessary. The fact that leucine leads to glycogen formation lends support to this view. W. D. H.

Fibrin Formation. By **Olof Hammarsten** (*Zeit. physiol. Chem.*, 1899, **28**, 98—114. Compare Abstr., 1897, ii, 152).—By means of repeated precipitations, fibrinogen was obtained almost free from calcium (0·006 per cent.). Ferment solutions were prepared from oxalated plasma which contained only 0·00004 to 0·0007 per cent. of calcium. On mixing the two solutions, typical fibrin was formed which contained only 0·006 per cent. of calcium, or in some cases even less. Fibrin is therefore not a calcium compound of fibrinogen. The small amount of calcium present must be regarded as an impurity, for if it were in chemical combination the molecular weight of fibrin must be greater than 800,000, or fifty times greater than that of oxyhæmoglobin. Quantitative experiments on the relationship of fibrin and fibrinogen showed that from 63 to 83 per cent. of the fibrinogen appeared as fibrin. In some of these experiments, calcium chloride was added, in others not; the difference in the amount of fibrin formed is always insignificant; if only a small amount of the calcium salt is added, fibrin formation is rather more rapid; if the amount of calcium salt is increased, the amount of fibrin formed is slightly diminished; in other words, it acts like other neutral salts.

The formation of fibrin from fibrinogen is usually regarded as a process of hydrolysis, the fibrinogen splitting into fibrin and fibrinoglobulin. Schmiedeberg's equation (*Arch. exp. Path. Pharm.*, **39**) for this would require that only 48—49 per cent. of the fibrinogen should appear as fibrin. The difference between the elementary composition of fibrin, fibrinogen, and fibrino-globulin is so slight as to suggest that the process is not necessarily one of hydrolysis at all. It may be that it is simply a matter of intramolecular rearrangement, varying quantities of the altered fibrinogen reappear as fibrin, and part remains in solution as fibrino-globulin. Possibly casein formation is similar.

W. D. H.

Origin of Fibrinogen. By ALBERT MATHEWS (*Amer. J. Physiol.*, 1899, **3**, 53—85).—The experiments recorded are believed to support the conclusion that the fibrinogen of the blood originates from the decomposing leucocytes, especially of the intestinal area. Fibrinogen increases when the number of leucocytes increases; after removal of the intestine, there is little or no renewal of the fibrinogen if the animal's normal blood has been previously replaced by defibrinated blood. This is not so when organs other than the intestine are removed. W. D. H.

Formation of 3-Methylxanthine from Caffeine in the Animal Organism. By MANFREDI ALBANESE (*Ber.*, 1899, **32**, 2280—2282. Compare Abstr., 1896, ii, 319, 492).—The change which caffeine undergoes on passing through the animal organism is somewhat different from that suffered by theobromine, which by dogs and rabbits is transformed into 7-methylxanthine (heteroxanthine). In dogs, caffeine is changed into 3-methylxanthine; in rabbits, into xanthine, and in man into dimethylxanthine, the latter being probably the 1 : 3-derivative. J. F. T.

Glycocine. By KARL SPIRO (*Zeit. physiol. Chem.*, 1899, **28**, 174—189).—Glycocine is obtained among the amido-acids which are decomposition products of many true proteids, and not only from albuminoids like gelatin. If this occurs also in the body, glycocine must be regarded as one of the precursors of urea. W. D. H.

The Melanin of the Eyeball. By HANS LANDOLT (*Zeit. physiol. Chem.*, 1899, **28**, 192—210).—The pigment granules of the retina have no stroma; the elementary composition of the pigment is C, 54·56; H, 5·34; N, 12·7; O, 27·4 per cent. The ratio C : N = 5 : 1. By the action of acids and alkalis, the composition changes, the carbon percentage rising, the nitrogen falling. Many previous observers have attempted to separate the pigment by a method involving gastric digestion; this accounts for the higher C : N ratio they have obtained. The end product of the action of boiling with acid, or of fusing with alkali, has a composition in which C : N = 13 : 2. By fusing with alkali, indole, ammonia, and volatile fatty acids are given off. By the action of acid, an aromatic complex giving Millon's reaction is formed. Although there is a probable relation between the pigment and proteid matter, the experiments given do not bear witness to any intimate relationship between the pigment and hæmoglobin or hæmatin. W. D. H.

"**Crystalline Fibrin.**" By S. DZIERZGOWSKI (*Zeit. physiol. Chem.*, 1899, **28**, 65—72).—Maillard (this vol., i, 466) has described a crystalline deposit which occurs in phenolised blood serum (ox and horse) when it is allowed to stand; he termed it crystalline fibrin.

The deposit, however, is partly amorphous; and by means of suitable solvents can be separated into four constituents; (1) calcium salts of the higher fatty acids; (2) compounds of these acids with glycerol and cholesterol; (3) proteid matter which is digestible by gastric and pancreatic juices; (4) nuclein. It is the two first upon which the crystalline character of the deposit depends. W. D. H.

Uric Acid in Mammals. By Oskar Minkowski (*Chem. Centr.*, 1899, i, 212—213; from *Arch. exp. Path. Pharm.*, **41**, 375—420).—Uric acid is synthetically formed in the liver of birds; the question investigated is whether mammals have a similar synthesising power. It was found, however, that after administration of large quantities of urea and ammonium sarcolactate, or allantoin, there is in dogs no rise in the amount of uric acid secreted.

Feeding on calves' thymus or nuclein from the salmon leads to a rise of the uric acid in the urine; but the nuclein bases do not act in this way. W. D. H.

Uric Acid Infarcts in New Born Children. By H. Spiegelberg (*Chem. Centr.*, 1899, 211—212; from *Arch. exp. Path. Pharm.*, **41**, 428—438).—The kidneys of children who die during the first weeks of life, show, as a rule, a deposit of urate crystals, the so-called uric acid infarcts. Experiments on dogs show that the adult organism is able to decompose far more uric acid than the young animal. After subcutaneous injection of uric acid in new-born animals, typical infarcts are formed. This relationship of the young animal to uric acid is something quite special. With other substances, there is no evidence of diminished power of oxidation. W. D. H.

Xanthine Bases in the Suprarenals. By Johann Okerblom (*Zeit. physiol. Chem.*, 1899, **28**, 60—64).—From 1·8 kilos. of fresh suprarenals, only 0·5 gram of xanthine bases was obtained; the principal base present is xanthine; then follow 1-methylxanthine, hypoxanthine, epiguanine, and adenine. W. D. H.

Oxidising Ferment of the Liver. By Martin Jacoby (*Virchow's Archiv*, 1899, **157**, 235—280).—The oxidising ferment of the liver resists to some extent the action of alcohol; small quantities of chloroform increase its activity, but in larger quantities of this reagent the activity of the ferment, as tested by the action of the minced organ on salicylaldehyde, is destroyed. The addition of small quantities of alkali furthers, but of larger quantities (beyond 0·3 per cent. of sodium hydroxide) destroys, its activity. Very small quantities of hydrochloric acid do not lessen its action, but when the concentration reaches 0·1 per cent., only traces of salicylaldehyde are oxidised. A temperature of 75° does not completely destroy the ferment, but one of 100° does so. Various substances were subjected to the action of the minced liver in order to see which of them were oxidised; no oxidising action was observed on sodium thiosulphate, sodium acetate, stearic, or palmitic acids. Sugar is not formed from these fatty acids. Uric acid also is not destroyed by calves' liver; but with dogs' liver there is some indication of oxidising action. In diabetes, the oxidising action of the liver is normal. The glycolytic ferment is not identical with the oxidising ferment; the former is destroyed at the comparatively low temperature of 58°, and is differently affected by chemical reagents as compared with the latter. Glycolysis appears to be a function of the cells. The liver is able to oxidise small quantities of arabinose. The change of glycogen into sugar does not appear to be due to the oxidising ferment. Oxidations in the body fall under three main headings: (1) those which are not fermentative; (2) those brought about by cells; and (3) those produced by oxidases in the body-juices. W. D. H.

Thyroid Gland. By Ernst Roos (*Zeit. physiol. Chem.*, 1899, **28**, 40—59).—A large number of estimations of the iodine in the thyroids of different animals are given. As a rule, this element is more abundant in the vegetable feeders; but it is sometimes absent even among these.

Renewed researches confirm the author's previous statements that the main active substance is iodothyrin. No actual observations are recorded on myxœdema, but other diseased conditions were observed, and experiments made on metabolism. W. D. H.

Physiology of the Iodine-containing Substance of the Thyroid Gland. By F. Blum (*Pfluger's Archiv*, 1899, **77**, 70—106). —Fresh experiments are recorded to confirm the author's previous conclusions (this vol., ii, 115) that the thyroid is an excretory organ removing poisonous substances from the blood, and that the iodine found there originates in this way. Iodothyrin is regarded as an artificial product; the iodine of the thyroid is in combination with proteid; the proteid is not fully saturated with iodine, and the amount of iodine per cent. varies considerably. The proteid itself belongs to the toxalbumins. Ostwald's thyreoglobulin, obtained by half-saturation with ammonium sulphate, is not a single substance. The thyroid gland is not to be regarded as an organ pouring a useful internal secretion into the circulation; the lymph leaving it, and the lymphatic glands in its vicinity do not contain iodine; and the blood and central nervous system in healthy animals are also free from iodine. Removal of the thyroid is followed by disease and death, because the organ which removes poisonous substances from the blood can no longer protect the animal. It is the central nervous system which principally suffers, and by Nissl's method great changes (chromatolysis) can be demonstrated in the ganglion cells. The thyroid therefore appears to be the great protective organ to the central nervous system. The poisonous substances are destroyed by oxidation, and this appears to be assisted by combination with iodine. W. D. H.

Coagulating Action of the Liquid of the External Prostate of the Hedgehog on the Contents of the Vesiculæ Seminales. By L. Camus and Eugène Gley (*Compt. rend.*, 1899, **128**, 1417—1419). —The prostatic liquid of several rodents coagulates the contents of their vesiculæ seminales. In the hedgehog, one of the Insectivora, there is a substance of the same order. This animal possesses a gland which appears to be an accessory prostate, and is termed the external prostate; its secretion, which is very alkaline, contains a ferment termed *vesiculase*, which causes a flocculent clot in the secretion (*vesiculin*) of the vesiculæ seminales. Its activity is destroyed at 69°. It does not act on the vesiculin of the guinea-pig, or *vice versâ*.

W. D. H.

Agglutination produced by the Albuminous Gland of Helix Pomatia. By L. Camus (*Compt. rend.*, 1899, **129**, 233—234).—An aqueous or saline extract of the albuminous gland of the snail, *Helix pomatia*, possesses the power of causing agglutination of milk globules and of blood corpuscles. W. D. H.

A Substance in the Blood which prevents the Action of Rennet on Milk. By A. Briot (*Compt. rend.*, 1899, **128**, 1359—1361). By L. Camus and Eugène Gley (*ibid.*, 1416—1417).—The blood serum of the horse and other animals contains a substance which is capable of neutralising the effects of a certain quantity of rennet. It does not dialyse, is destroyed by heat, and is precipitable by alcohol and by ammonium sulphate. On these grounds, it is believed to be an enzyme. Egg-white has the same power. The anti-rennet action of the serum of an animal can be augmented by repeated injections of rennet subcutaneously.

Camus and Gley point out that they have previously described the anti-rennet action of serum, and that serum also acts counter to pepsin and trypsin. W. D. H.

Composition of Cerebro-spinal Fluid. By Guerbet (*J. Pharm.*, 1899, [vi], **10**, 59—61. Compare Abstr., 1898, ii, 36).—The reducing substance present in cerebro-spinal fluid is not precipitated by lead acetate, and its solution is not darkened by alkalis or coloured by ferric chloride. The author concludes that it is not catechol, nor can it be glucose, since its solution is without action on polarised light, and gives no precipitate with phenylhydrazine acetate. Unsuccessful attempts were made to isolate the reducing substance.

H. R. Le S.

Fate of Cholesterol in the Animal Organism. By Vincenz Humnicki (*Chem. Centr.*, 1899, i, 369; from *Dissert. Freiburg*, 1898).—In the human body, chloresterol is discharged in the fæces as coprosterol. Particulars are given of the crystalline form, melting point, &c., of compounds of this substance with acetyl, propionyl, benzoyl, and other radicles.

Coprosterol was not obtained by the putrefaction of cholesterol *in vitro*. In dogs, cholesterol is contained in the fæces as such. In horses, a different reduction product, hippocoprosterol, was obtained; but its formula was not determined; it crystallises in short needles, and melts at 74—75°. W. D. H.

Excretion of Uric Acid. By Schreiber and Waldvogel (*Chem. Centr.*, 1899, i, 849; from *Arch. exp. Path. Pharm.*, **42**, 69—82).—Two students fasted for three days. At the beginning of the research, they passed daily 0·477 and 0·718 gram of uric acid respectively, and on the third day 0·197 and 0·205 gram. The amount of uric acid does not run parallel to the total nitrogen or to the acidity of the urine; it does not disappear with vegetable diet. Animal food causes a rise in the xanthine bases, but not in the uric acid excreted, whilst salicylic acid causes a rise in both. W. D. H.

Action of Hydrogen Peroxide on Urine. Origin of Acetone. By S. Cotton (*J. Pharm.*, 1899, [vi], **10**, 193—200).—Acetone is present in all animal liquid secretions, and in urine more than in any other; it is also present in the breath. Besides acetone, normal urine may also contain other ketones which give the iodoform reaction. Acetone is produced from nearly all organic compounds when they are heated with hydrogen peroxide. Citric acid, tartaric acid, glycerol, and the sugars give a large amount of acetone; the oils and fats give a small amount of acetone but much acraldehyde, and the proteids give a large amount of acetone and benzaldehyde.

H. R. Le S.

Action of Mineral Substances and Organic Acids on the Resistance of the Body to Disease. By Albert Charrin, Guillemonat, and Levaditi (*Compt. rend.*, 1899, **129**, 305—307. **Immunity and Specificity.** By Charles Bouchard (*ibid.*, 308—311).—During several weeks, rabbits received every day or two subcutaneous injections of increasing quantities of a saline solution containing sodium sulphate, phosphate and chloride, and potassium phosphate. Other rabbits received injections of organic acids like lactic, oxalic, and citric. The diet throughout was constant. Finally, they were inoculated with cultures of *Bacillus pyocyaneus*. The 'acid animals' died more quickly and the 'saline animals' lived much longer than normal animals; *post mortem*, the bone marrow of the saline animals was found to be hypertrophied, and had lost some of its fat.

Bouchard points out that these results confirm his theories of immunity. W. D. H.

Orthamidophenetidine [Relation of Constitution and Physiological Action]. By Georg Cohn (*Ber.*, 1899, **32**, 2239—2243).—See this vol., i, 944.

Effect of Inorganic Solutions, and Solutions containing Serum-albumin on the Frog's Heart. By E. C. Walden (*Amer. J. Physiol.*, 1899, **3**, 123—133).—If a heart is stopped by irrigation with normal saline solution, Ringer's solution sets it going again, and if this brings it, as it will in many hours, to a standstill, increase of the calcium in the fluid once more causes recovery. Blood serum, or milk, has little or no effect in this direction. Experiments with pure serum-albumin show that it has none of the special nutritive value in connection with the heart which has been attributed to it by Kronecker. W. D. H.

Behaviour of Salol and Distearyl Salicyl Glyceride in the Organism. By Vincenz Humnicki (*Chem. Centr.*, 1899, i, 369; from *Dissert. Freiburg*, 1898).—After taking salol, the separation of salicylic acid in the urine occurs more slowly than after taking salicylic acid. Distearyl salicyl glyceride, in contradistinction to trisalicyl glyceride, is almost completely absorbed. The passage of salicylic acid into the urine takes place more slowly after taking salol than after the administration of sodium salicylate. W. D. H.

Physiological Action of Choline and Neurine. By Frederick W. Mott and William D. Halliburton (*Proc. Roy. Soc.*, 1899, **65**, 91—94; *Phil. Trans.*, 1899, **191**, B, 211—267. Compare Abstr., 1897, ii, 222; 1898, ii, 242; this vol., ii, 315).—A full account of a research of which preliminary communications have already been made.

W. D. H.

Physiological Effects of Extracts of the Pituitary Body. By Edward Albert Schäfer and Swale Vincent (*J. Physiol.*, 1899, **25**, 87—97. Compare this vol., ii, 441).—Extracts of the infundibular (not the hypophysal) part of the pituitary body contain two substances, one of which, when injected intravenously, produces a rise, the other a fall, of blood pressure. The rise is partly of cardiac origin, and is partly due to constriction of the peripheral vessels. After atropine, the rise is enormous; it differs from that produced by suprarenal extract in that a second dose given soon after the first fails to produce any effect. This allows the second substance to have full play, and the fall of blood pressure may be obtained any number of times with successive doses. The subcutaneous injection of the extracts in small mammals causes paralytic symptoms, similar to those obtained by injecting suprarenal extracts.

The characteristic effects produced by extracts of the infundibular body are probably not due to the grey, nervous matter of which it is largely composed. The substance which produces the fall of blood pressure is not choline, although like it at first sight. After a small dose of atropine, the action of the infundibular depressor substance is unaffected, whereas that of choline is abolished, or even a rise of blood pressure produced. The chemical nature of neither of the active substances was made out; they are not destroyed by boiling, and are dialysable; they are not proteid in nature; the depressor substance is soluble in salt solution, in absolute alcohol, and in ether; the pressor substance is soluble in salt solution, but not in absolute alcohol or in ether. W. D. H.

The Relation of the Toxin and Anti-Toxin of Snake Venom. By Charles James Martin (*Proc. Roy. Soc.*, 1898—1899, **64**, 88—94. Compare this vol., ii, 234).—This is a record of fresh experiments to support the previous conclusions of the author that the reaction of toxin and anti-toxin is a chemical one. About the same quantity of anti-venen necessary to neutralise the venom *in vitro* is capable of doing so when the former is injected into the blood stream and the latter subcutaneously. In fact, the two can be accurately titrated against one another with the life of a rabbit as indicator. Fraser's statement is, however, confirmed that at least ten to twenty times the amount of anti-venen is necessary if both it and the venom are injected subcutaneously. In other words, anti-venen is slowly absorbed from the subcutaneous spaces; this is owing to the large size of its molecules. In snake bite, therefore, the curative serum should be injected intravenously. W. D. H.

Echidnase. By C. Phisalix (*Compt. rend.*, 1899, **129**, 115—117).—The experiments recorded are considered to show that a ferment (echidnase) in the venom of vipers exercises a digestive action, not only on the tissues of the animals inoculated, but also on the active principle (echidno-toxin) of the venom. This is supposed to be an internal cause of the destruction of the poison, which aids various external forces (oxygen, light, heat, electricity) that act in the same way. W. D. H.

Immunity of certain Animals to the Poisonous Action of Eel's Serum. By L. Camus and Eugène Gley (*Compt. rend.*, 1899, **129**, 231—233).—The frog, toad, fowl, pigeon, and other animals resist the toxic action of eel's serum. This is not due to any material in the blood-plasma (*humoral* immunity) but to a special cellular organisation giving to the red corpuscles a specific resistance. This is termed *cytological* immunity. W. D. H.

Phosphorus Poisoning and Phloridzin Diabetes. By W. E. Ray, T. S. McDermott, and Graham Lusk (*Amer. J. Physiol.*, 1899, **3**, 139—155).—In dogs diabetic with phloridzin, phosphorus poisoning does not materially increase the proteid metabolism nor change the excretion of sugar. In dogs poisoned with phosphorus, phloridzin causes the usual sweeping out of the body sugars; then the establishment of the ratio in the urine of dextrose to nitrogen of 3·75 to 1. It causes further an increase of proteid metabolism, and the urine, from being ammoniacal, becomes acid. In one animal, tyrosine crystals were excreted temporarily. The vomit in phloridzin diabetes does not contain sugar. Six minutes after the subcutaneous injection of phloridzin, sugar may be detected in the urine. *Post mortem* after phloridzin diabetes, much fat is found in liver, kidneys, heart muscle, and voluntary muscle. After both phloridzin and phosphorus, the same is found, *plus* fragmentation of the liver nuclei. After phosphorus alone, fat is found in the liver, and in the kidney (slightly), but none in muscle; there is fragmentation of the liver nuclei.

The following general explanation is offered for phloridzin poisoning: the high proteid decomposition is due to the non-burning of the carbohydrate-like radicle of the proteid molecule. In phosphorus poisoning, the high proteid decomposition is due to the conversion of this radicle into leucine, tyrosine, and fat (fatty *degeneration* in Virchow's sense); wherever the sugar from proteid is not burned, pathologically hungry cells are found, which attract fat to themselves in larger quantities than can be utilised (fatty *infiltration*). Infiltration takes place generally in the tissues in phloridzin diabetes; infiltration and degeneration take place in phosphorus poisoning, especially in the liver. W. D. H.

Chemistry of Vegetable Physiology and Agriculture.

Artificially increasing the Quantity of Zymase in Yeast. By Robert Albert (*Ber.*, 1899, **32**, 2372—2374).—When yeast, which, under treatment by Buchner and Rapp's method (Abstr., 1898, ii, 127), yields an aqueous extract of feeble activity, is allowed to ferment a solution of cane-sugar, dipotassium phosphate, and magnesium sulphate to which hop-infusion has been added, it is found that the extract subsequently obtained from the yeast possesses considerably increased fermenting power. An extract prepared from the yeast when most actively fermenting the nutrient solution contains less zymase than at any other time; when the fermentation is complete, the proportion of zymase present is a maximum, and is not increased either by lowering the temperature during nutrition or by leaving the yeast in contact with the nutrient medium for a longer period, although rendered greater by increasing the amount of cane sugar originally present in the latter. W. A. D.

Variations in the Production of Glycerol in the Alcoholic Fermentation of Sugar. By J. B. VINCENT LABORDE (*Compt. rend.*, 1899, **129**, 344—347).—The fermentation of grape juice by different yeasts yields proportions of glycerol varying from 2·5 to 7·75 per 100 grams of sugar, according to the nature of the yeast, the highest quantity being obtained with Sauterne yeast and with a Martinique yeast from the fermentation of sugar-cane syrup. The feebler the activity of the yeast, or the less favourable the conditions with respect to active fermentation, the higher the proportion of glycerol formed. An increase in the proportion of sugar increases the proportion of glycerol, and increased acidity has a similar effect. If all the natural acid exceeding 1 per cent. is carefully neutralised, the variations in the proportion of glycerol become very small. Increased temperature promotes the formation of glycerol. With the same sugar and the same yeast, the proportion of glycerol is highest in the early stages of fermentation and diminishes as the change proceeds, because alcohol tends to prevent the formation of glycerol.

The proportion of glycerol is affected by the nature of the sugar as well as by the nature of the yeast, and different sugars may, from this point of view, arrange themselves in different orders with different yeasts.

The high proportion of glycerol found in special wines such as Sauternes is in part due to the action of *Botrytis cinerea* on the must before fermentation. C. H. B.

Fermentation of Barbary Figs. By ROLANTS (*Ann. Agron.*, 1899, **25**, 395—396; from *Ann. Inst. Pasteur*, **13**, 152).—Indian or Barbary figs (*Cactus opuntia*) contain the following amounts of constituents per cent.: water, 84·65; sugar, 10·00; pectic substances, 1·573; extractive substances, 2·614; ash, 1·057. The acidity (as sulphuric acid) is 0·036.

The chief difficulty in utilising figs for obtaining alcohol is the presence of pectic substances, which, however, are rendered insoluble by heating for 20 minutes at 120°. The yield of alcohol is 41 litres from 1000 kilos. of fruit. The alcohol is of good quality and contains aromatic etheric salts of agreeable odour which can be readily removed by rectification. N. H. J. M.

Acetic Acid Bacteria. By D. P. HOYER (*Chem. Centr.*, 1899, i, 854; from *Arch. Néerl. Sci.*, [ii], **2**, 191—240).—*Bacterium aceti* and *B. xylinum* differ from *B. rancens* and *B. pasteurianum* in their power of inverting sugar. Malic and citric acids and their salts induce fundamental changes in the form of the bacteria of beer vinegar. Acetic acid bacteria live in absence of air, and under this condition reduce indigotin, methylene-blue, and litmus. The development of the bacteria is accompanied by elimination of carbonic anhydride. As sources of nitrogen, they can utilise peptone, asparagine, nitrites, and ammonium salts, whilst acetic acid, sodium acetate, potassium lactate (and for *B. aceti* and *B. xylinum* also cane-sugar) serve as sources of carbon. The nature of the carbonaceous food determines the assimilability of certain nitrogenous substances, and *vice versâ*. A distinction is made between the substances essential for the growth of the cells ("genetic") and others ("zymotic") such as lactic, succinic, malic, and gluconic acids, and calcium lactate, acetate, and propionate. Tartaric acid is not attacked. Less than 4 per cent. of alcohol has no effect on the growth of the bacteria; a larger amount hinders, and about 9 per cent. stops their development. Acetic acid hinders the growth.

N. H. J. M.

Nitragin and the Nodules of Leguminous Plants. By Maria Dawson (*Proc. Roy. Soc.*, 1898, **64**, 167—168).—The parasitic nature of both the filaments and the bacteroids in root nodules is confirmed. The infection tubes and the filaments in the cells consist of straight rodlets imbedded in a colourless matrix which does not consist of cellulose, chitin, or any form of slime. When the rodlets are liberated by the bursting of the filaments, they become transformed into X-, V-, and Y-shaped bacteroids. This change of form does not occur outside the plant on solid media, but takes place in liquid pea extract. It is uncertain whether the change in form is due to branching or to fusion of two or more individuals. Their multiplication by division would indicate that the organisms are members of the *Schizomycetes*. The bacteroids seem to be incapable of further growth. They are aërobic.

Nitragin consists of minute, micrococcus-like bodies all straight and immobile. Crossing of kinds supplied for different genera and species is successful within the tribe of *Vicieæ*. Infection of quite young radicles is tolerably certain, and of older roots when the condition under which they germinated is maintained. The accumulation of carbonic anhydride round the roots is not the cause of failure in direct infection.

Application of nitragin to soils rich in nitrates seems to be inadvisable; when nitrates are deficient, its application results in an increased yield, but the addition of nitrates instead of nitragin gives still better results. N. H. J. M.

Respiration of Mould Fungi in different Nutritive Solutions. By Konstantin A. Puriewitsch (*Chem. Centr.*, 1899, i, 1251, from *Ber. deut. botan-Ges.*, **16**, 290, and *Centr. Bakt. Par.* [ii], **5**, 223—224). —The results of experiments in which *Aspergillus niger* was cultivated in solutions containing dextrose, saccharose, mannitol, and tartaric acid showed that the quotient CO_2/O_2 rises with the concentration of the solution up to a certain point, and then falls again.

N. H. J. M.

Action of some Poisons on Yeast and on Fermentation. By Carl Wehmer (*Chem. Zeit.*, 1899, **23**, 163—165).—The want of agreement in the results of experiments hitherto made on the effect of poisons on yeast is attributed to the amount of yeast employed not being taken sufficiently into account. In the experiments now described, the amounts of yeast were the same in each case, and also the amounts of wort.

With 5 grams of yeast and 50 c.c. of wort, 1 gram of potassium and sodium arsenite had in 80 hours no effect, whilst formalin (0·5 c.c. = 0·2 c.c. formaldehyde), chloroform (0·5 c.c.), mercuric chloride (0·25 gram), and benzoic acid (0·5 gram) almost completely checked fermentation. Even 10 per cent. of potassium arsenite did not entirely suppress fermentation. In absence of yeast, or with very little yeast, 1—2 per cent. of arsenite will prevent decomposition of wort for months.

Yeast which has ceased to be active after addition of arsenites, &c., is not necessarily dead. Alkali arsenites (1—2 per cent.) generally destroy yeast after 2—3 weeks, but had no appreciable effect in 3—4 days; with mercuric chloride (0·1—0·25 gram in 100 c.c.), most of the yeast cells were alive after 3 days, but were all killed in 5 days. Benzoic acid, which at once checked fermentation, required more than 1—2 weeks to destroy the yeast, whilst chloroform proved to be the least destructive. N. H. J. M.

Chemical Physiology of Ethereal Oils. By THOMAS BOKORNY (*Chem. Zeit.*, 1899, **23**, 60—61 and 75—76. Compare this vol., ii, 318).—Although ethereal oils probably play no part in plant assimilation, the author suggests that their function may be that of antiseptics. The action of the following substances, which occur in various ethereal oils on different minute organisms such as bacteria, moulds, &c., has been studied, and, with the single exception of saligenin, all have proved to have antiseptic properties. Eugenol, cinnamaldehyde, vanillin, salicylaldehyde, saligenin, benzaldehyde, piperonal, coumarin, borneol, carvacrol, thymol, oil of lavender, oil of turpentine, menthol, carvene, carvol.

Most of the substances were employed in 0·1 per cent. aqueous solution. J. J. S.

Antiseptic Action of Salicylaldehyde and Benzoic Anhydride. By ERNST SALKOWSKI (*Virchow's Archiv*, 1899, **157**, 416—424).—Bokorny has recently (this vol., ii, 318) called attention to the poisonous action of salicylaldehyde on fungi. The author has already pointed out the antiseptic action of this substance and of benzoic anhydride (*Centr. med. Wiss.*, 1887, No. 51); he now presents experiments which illustrate this action. W. D. H.

Action of Enzymes and Substances which kill Bacteria. By SACHAROFF (*Chem. Centr.*, 1899, i, 941—942; from *Centr. Bakt.*, *Par.*, [i], **25**, 346—350).—Iron nuclein can be separated from papayotin more readily by water and hydrogen peroxide than by water alone, and the filtrate is almost free from iron. Addition of ammonium or hydrogen sulphide to the liquid again induces the property of dissolving gelatin, owing, probably, to the presence of traces of iron-nuclein remaining even after repeated filtration. The checking of the dissolving action of papayotin is attributed, not to its destruction, but to the presence of hydrogen peroxide.

Oxidation in dead or living organisms and in blood is due to the presence of enzymes, and the iron-nuclein present in cell-protoplasm. Active iron-nucleins, the author terms bionucleins.

The author assumes that a bionuclein is present in diphtheria toxin. Toxoids (Ehrlich, *Deut. Med. Woch.*, **24**) are probably toxins which have lost their bionuclein through oxidation. N. H. J. M.

Mutual Relations of the Decompositions of Albumin and of Respiration. By Dmitri N. Prianischnikoff (*Landw. Versuchs-Stat.*, 1899, **52**, 137—164. Compare Abstr., 1896, ii, 380).—Experiments on the germination of peas, lupins, and vetches in the dark showed that the maximum decomposition of proteids and the maximum production of asparagine took place at nearly the same period (about the 7th to 9th day), and some days earlier than the maximum elimination of carbonic anhydride. At the conclusion of the germinating period, the energy of accumulation of asparagine became greater than the rate of decomposition of proteids, asparagine being then produced from amido-acids, if the possibility of its production from newly-formed proteids (at a period when the conditions are favourable to destruction rather than formation of proteids) is not admitted. This involves the breaking up of two mols. of amido-acid, one of which must be oxidised in order to furnish the NH_2-group, the other only sufficiently oxidised to yield aspartic acid.

Whilst, according to Loew and Palladin, the decomposition of proteids is a process of oxidation, and according to E. Schulze a process of hydration, the author considers that both processes are successively involved: first a hydration of the proteid molecule, and subsequently oxidation with production of ammonia and also asparagine. This would be analogous to what takes place in the animal organism.

N. H. J. M.

Progress of Assimilation in Oats in the Field and in Pots. By Adam Karpinski (*Bied. Centr.*, 1899, **28**, 546—550; from *Zeit. landw. Versuchswesen Österr.*, 1898, i, 387).—Field experiments with oats were made at Dublany, in which four plots received (1) no manure, (2) Chili saltpetre, (3) Chili saltpetre applied at two different periods, and (4) ammonium sulphate. A similar set of experiments was made with the same soil in pots. Samples of the plants from both sets were taken at four successive periods of growth.

The results of the two series of experiments differed in several respects. The pot plants contained about half as much nitrogen again as those grown in the field, and were in every respect more strongly developed. This difference is attributed to the difference in the amounts of water at the disposal of the two sets of plants, and to the fact that there was no loss of soluble manure in the pots through leaching.

In the field, ammonium sulphate proved to be better than the nitrate, whilst in pots the nitrate was more effective. Phosphoric acid was taken up chiefly in the first two periods in the field experiments, whilst in the pots it was taken up in the third and fourth periods, although to a less extent than in the first and second.

The roots of both field and pot plants were found to be rich in nitrogen and phosphoric acid during the first period of growth. The roots of the pot plants were much richer in these constituents than those of the field plants, owing, perhaps, to the greater amount of water in the soil of the pots. N. H. J. M.

Influence of Light on the Growth of Clover. By AIMÉ PAGNOUL (*Ann. Agron.*, 1899, **25**, 353—356).—Incarnate clover was grown in pots, one pot being exposed to strong light, whilst the other was shaded. Under the influence of strong light, the growth was normal, but the plants screened from direct light developed very badly. The evaporation from both pots was determined during the whole period of growth (May 1 to June 7). At the conclusion, the following results were obtained:

	Evaporation. c.c.	Fresh produce. Grams.	Dry produce. Grams.	Nitric N. in dry produce. Per cent.
1. Plants in strong light......	3475	31·68	6·23	0·0
2. ,, shade	1715	4·54	0·40	0·001125

There was thus an accommodation of nitrates in the shaded plants which the plants were unable to reduce. At an earlier stage (May 11), the plants exposed to full light contained a small amount of nitric nitrogen (0·000035 per cent.), but this was completely used up during the next month. N. H. J. M.

Forms and Conditions under which Chlorine is usually taken up by Plants. By P. PICHARD (*Compt. rend.*, 1899, **128**, 615—617).—In most soils, chlorine is present in the form of sodium chloride, but in some calcareous and magnesia soils, which are common in Algeria, calcium and magnesium chlorides occur. The drainage from such soils is alkaline and contains sodium carbonate (*ibid.*, 1876).

Experiments are described in which tobacco was grown in artificial and in natural soils containing varying amounts of chlorides, in addition to nitrates; more or less potash was present in most cases. All the plants were found to contain some chlorine, and when the soil contained only a little sodium chloride, the whole of the chlorine was absorbed by the plants. Generally, the proportion of chlorine in the plants increases in the relation to the amount in the soil under conditions otherwise equal. Most, if not all, of the chlorine in the plants was in the form of potassium chloride; an increase in the amount of potash in the soil induces increased absorption of chlorine by the plants. Tobacco leaves may contain as much as 11·23 per cent. of potassium chloride.

Sodium chloride occurs only exceptionally in tobacco, and only when the soil contains as much as 0·1 per cent.; the sodium in tobacco occurs only in the form of chloride. It is concluded that, in contact with roots, sodium chloride decomposes potassium salts, with production of potassium chloride, which is retained by the plants, whilst the newly-formed sodium salts are returned to the soil.

It was previously shown that the nitric acid of the soil has a very marked tendency to penetrate into the tobacco plant as potassium salt, and to utilise potassium originally present in very insoluble forms, such as clay and various silicates (Abstr., 1895, ii, 60). The presence of chlorides in soil, and their tendency to be absorbed by plants, is antagonistic to the taking up of nitrates; and it is only owing to their predominance in the soil that nitrates can be absorbed. Diminution of the amount of nitrates in soil gives rise to increased absorption of chlorides. N. H. J. M.

The Rôle of Sodium in Plants. By M. STAHL-SCHRÖDER (*Chem. Centr.*, 1899, ii, 693; from *J. Landw.*, **47**, 49—84).—The results of field and pot experiments with oats showed that in presence of plenty of potassium, sodium is only taken up largely when in combination with some acid of which the plant requires considerable amounts, such as phosphoric and nitric acids. In accordance with Contejean's and Guitteau's results, it was found that the sodium remained mainly in the lower parts of the plants. Oats can assimilate large amounts of sodium without injury.

Further experiments with peas, oats, carrots, and buckwheat showed that sodium cannot replace the potassium necessary for the production of the organic matter of plants. The alleged economising of potash manures by soda is attributed to indirect action, only observed in the case of soils which contain plant food in sparingly soluble forms.

N. H. J. M.

Physiological Functions of Calcium Salts. By OSCAR LOEW (*Bied. Centr.*, 1899, **28**, 541—542; from *Bot. Centr.*, 1898, **74**, 257—265).—Calcium salts assist in the organisation of the cell-nucleus and chlorophyll substances by forming compounds of calcium with proteids. Whilst strontium salts are injurious to plants in absence of lime, a sufficient quantity of lime renders strontium almost harmless; analogous results were obtained with magnesium salts in the place of strontium salts. It is concluded that in absence of sufficient lime, the partial exchange of strontium or magnesium for calcium in the calcium-nuclein compounds of the nucleus results in local structural disturbances. If the functions of calcium were merely connected with metabolism, strontium might be expected to perform such functions equally well. The view that calcium is mainly of importance in precipitating oxalic acid is opposed to the fact that certain plants which require much lime are as free from oxalic acids as some other plants which require less lime. The importance of lime for chlorophyll substances is indicated by the fact that leaves are the organs which contain the most lime, that etiolated leaves contain less lime than green ones, and that the whole leaf suffers in absence of a sufficient supply of lime (compare Abstr., 1896, ii, 446).

N. H. J. M.

Spontaneous Asphyxia and Production of Alcohol in the Deep Tissues of Woody Stems growing under Normal Conditions. By HENRI DEVAUX (*Compt. rend.*, 1899, **128**, 1346—1349).—The internal atmosphere of woody stems frequently contains less than 10 per cent. of oxygen, whilst that of the deeper tissues must contain still less. On increasing the respiration by keeping stems at 35° for 3 days, the percentage amount of oxygen in the internal atmosphere was greatly reduced, in one case to as little as 0·22 per cent., in four cases to much less than 1 per cent., whilst with two other stems the amounts were reduced from 16·32 and 13·12 to 8·62 and 4·04 respectively.

The respiratory coefficient, CO_2/O_2, is usually constant and less than unity. In these experiments, with increased respiration, this coefficient was, with one exception, greater than unity, and in some cases much greater. These results indicate decomposition of the sugar of the living cells, and it was found that alcohol is, in fact, produced, both at the ordinary temperature and to a greater extent at 35°. N. H. J. M.

Formation, Storage, and Depletion of Carbohydrates in Monocotyledons. By John Parkin (*Proc. Roy. Soc.*, 1898, **64**, 122—123).—The investigation of about 70 species, belonging to the principal groups of monocotyledons, showed that the amount of starch, due to normal assimilation in the leaves, varies considerably in different genera. Relatively few produce much, and some none, but species from most of the principal families form some starch in their mesophyll.

On comparing the type of leaf, its position and age, some connection seems to exist with the storage or non-storage of temporary starch; broad leaves, those of aquatic monocotyledons and those working at higher temperatures in the summer, seem more liable to have starch than narrow radical leaves, leaves in dry situations and those of spring species. It was found that starch is developed in the young leaves of *Allium*, a genus long known not to form starch under ordinary conditions, so that the age of the leaf would also seem to affect the question.

Cane sugar was found to produce starch far better than any other sugar in pieces of leaves floated on the solution, invert sugar, glucose, and fructose following next in order, whilst maltose is almost useless.

Inulin is by no means uncommon in monocotyledons, and may coexist with starch in the same cell. It is not stored in aquatic species. Whilst ordinary inulin from *Helianthus* and other *Compositæ* dissolves at about 50°, inulin from *Scilla* dissolves readily in cold water, and inulin from *Galanthus* requires water at 80° for solution. N. H. J. M.

Darkening of Sugar Beet Juice. By Max Gonnermann (*Chem. Zeit.*, 1899, **23**, 213—215 and 240—242).—Albuminous compounds present in sugar beet are converted by the catalytic action of enzymes into tyrosine, and subsequently into dihydroxyphenylacetic acid, a substance which, when exposed to air, acquires a cherry-red colour or becomes black. No coloration takes place in absence of oxygen or in presence of mineral acids. Slight alkalinity at once produces the coloration.

The process takes place to a slight extent in leaf stems and in the roots; in cut roots and expressed juice, the rate of darkening increases as access of air is increased.

Dihydroxyphenylacetic acid can be detected after keeping fresh beet-root juice for a week in an atmosphere of hydrogen.

N. H. J. M.

Root Excretions. By Rudolf Kohn (*Landw. Versuchs.-Stat.*, 1899, **52**, 315—326).—On inserting acid roots in one arm (A) of a U-tube containing very dilute red litmus solution, it was found that the litmus in the other arm (B) soon became blue. The alkalinity could also be observed with very sensitive litmus paper when water alone, or water containing neutral manures, was employed. The action was more rapid in direct sunlight than in diffused light. In some cases, it was found possible by removing the root from (A) to (B) to reverse the colours. With some plants, the red colour in the arm containing the root extended to the end of the other arm. Plants with very slightly acid roots produced little or no alkalinity. Weeds were found to be more suitable than cultivated plants, as the latter generally died quickly.

The results are attributed to electrochemical action; and attention is called to the fact that roots, like electrodes, are able to withdraw the last traces of dissolved substances. N. H. J. M.

Production of Sugar in Beet. By Max Gonnermann (*Bied. Centr.*, 1899, **28**, 550—554; from *Bl. Zuckerrübenbau*, No. 20, 309, No. 21, 327)—The seeds of sugar beet do not contain saccharose; the first product of the decomposition of starch seems to be amidulin, after which monosaccharides are produced. The seeds contain an enzyme which is not diastatic. In leaves of eight day plants, neither saccharose nor amidulin could be detected, and the presence of starch was doubtful.

New leaves from old roots contained an inverting enzyme, but the extract had no diastatic effect on starch. Neither the roots nor the new growth of leaves contained lævulose.

Leaves of winter rye contain amidulin and glucose, but no starch. Young leaves of summer rye contain saccharose, but no amidulin, starch, or reducing sugar; the roots contain saccharose, but no amidulin, indicating that the starch is rapidly converted directly into saccharose by a ferment (which was isolated) in the seeds. Diastase is present in undeveloped barley grain. It is concluded that, speaking generally, all seeds contain ferments to decompose the starch, and that amidulin is first formed, and then glucose.

Sugar beet plants 14 days old contained a small amount of sugar in the roots; the leaves contained both an inverting and a diastatic enzyme, to which the production of amidulin in the leaves, and sugar in the roots are due. At a later stage, when the plant had eight leaves, the roots contained only saccharose, and no dextrose or starch; the leaves contained saccharose and reducing sugar, but no amidulin, and starch was only present on the upper sides of the leaves.

Bertrand's tyrosinase is one of the enzymes present in beet leaves and stems. The enzymes produce on the one hand the conversion of starch into amidulin, glucose, and saccharose, and, on the other hand, are the cause of the darkening of fresh beet juice.

It is proposed to designate the beet ferments, which differ from invertin of yeast, and the diastase of barley, beet-invertase, and beet diatase respectively. The author considers that he has established that sugar is only produced in beet by the intervention of enzymes.

N. H. J. M.

Physiological Importance of Furfuroids in Sugar Beet. By JULIUS STOKLASA (*Chem. Centr.*, 1899, i, 890; from *Zeit. Zucker-Ind. Böhm.*, **23**, 291—294).—The testa of sugar beet seed is very rich, the pure seeds poor, in furfuroids. During growth, there is a considerable increase in the amount of furfuroids in the seedlings. In the leaves of 10-day old plants, 66·9 per cent., and in the roots 19·6 per cent., of the furfuroids are soluble in water; after 120 days, 39·84 per cent. in the leaves and 14·1 per cent. in the roots dissolve in water, whilst at the end of the vegetating period the dry substance of the leaves yielded 5·88 per cent. of furfuraldehyde, of which the aqueous extract yielded only 0·92 per cent.

Manuring with excessive amounts of nitrate increases the amount of furfuroids and diminishes the production of sugar. Large amounts of soluble phosphates and potassium chloride have the same effect. The result with potassium chloride is in accordance with the fact that chlorine energetically induces the transformation of sugar and promotes the production of hemicelluloses and celluloses. Soil free from lime produced plants containing a smaller amount of substances yielding furfuraldehyde than lime soils.

The dry matter of sugar beet roots, in the first year, contained: hemicelluloses, 14·48; celluloses, 5·22; lignin, 5·03; and yielded 6·3 per cent. of furfuraldehyde. In the second year, the amounts were 11·66, 15·23, 29·84, and 9·02 per cent. respectively. In the first year, most of the pentosans are in the form of hemicelluloses, in the second year they increase in the cellulose groups, and especially in the lignin substances.

N. H. J. M.

Chlorophylls and the Chlorophylls of Ferns. By ALEXANDRE ÉTARD (*Ann. Agron.*, 1899, **25**, 393—394; from *Ann. Inst. Pasteur*, **13**, 456. Compare this vol., i, 381).—Several different chlorophylls may exist in the same plant, and the total number of chlorophylls is greater than the number of different species of plants. Although these substances do not seem to take part in the first stages of growth, it is probable that a trace of the matter which produces them exists among the latent functions of the germ.

As regards the theory that chlorophyll produces formaldehyde from the elements of carbonic anhydride and water, it is pointed out that the fatty or waxy character of chlorophyll is inconsistent with this property; and it is further suggested that all the elements usually found in plants are concerned in the synthesis. Hoppe-Seyler, Gautier and the author have always found associated with chlorophyll a certain amount of mineral matter which, it is suggested, may have a rôle analogous to that of manganese in the biological process of oxidation (compare Bertrand, Abstr., 1898, ii, 128).

The following substances were isolated from ferns (*Aspidium filix fœmina*): an alcohol, $C_{16}H_{32}O$; carrotene, and three *aspidiophylls*, having the formulæ $C_{208}H_{347}O_{32}N$, $C_{240}H_{320}O_{31}N_2$, and $C_{21?}H_{346}O_{48}N_{20}$ respectively. N. H. J. M.

A Proteid Compound of Arginine. By U. Susuki (*Chem. Zeit.*, 1899, **23**, 658).—According to Loew, the greater quantity of the arginine obtained from the seeds of conifers exists ready formed, but in a loose combination with the proteid material. The author supports this view, as he finds that the proteids from various Japanese conifers yield small quantities of amido-acids when boiled for some hours with 0·5 per cent. hydrochloric acid; in some cases, 2/3 of the arginine appears to be thus loosely combined. J. J. S.

Peptonising Enzyme (Peptase) in Malt. Separation of Nitrogenous Constituents of Malt, Wort, and Beer. By Boleslaw de Verbno Laszczynski (*Chem. Centr.*, 1899, i, 698—699, 852—853, and 939—940; from *Zeit. ges. Brauw.*, **22**, 71—73, 83—86, 123—129, and 140—143).—Barley seedlings, beginning to become green, had no enzymic action on fibrin (compare Neumeister, Abstr., 1895, ii, 290), but green and dark kiln-dried malt showed a distinct action. In no case, however, was there any action in 6 hours at 40°, whilst addition of 10 milligrams of pepsin acts at once.

Malt, wort, and beer do not contain peptone, and the solubility of nitrogenous substances in malt depends on the conditions of extraction. The nitrogen compounds are (1) coagulable proteids, (2) albumoses, and (3) amides. The first are only completely separated by heating for 1 hour at 1½ atmospheres pressure, and are also precipitated by phosphotungstic acid and copper hydroxide. The latter, however, only partially precipitates those substances which can be separated by zinc sulphate. Copper sulphate precipitates a portion of the albumoses and amides. Phosphotungstic acid separates albumoses, xanthine bases, and a part of the amides.

Sodium hydrogen sulphate and copper sulphate precipitate the xanthine bases in malt extract, &c., but the proteids and albumoses must be first separated, as they are also precipitated.

Uranium acetate does not precipitate all the substances separated by phosphotungstic acid. The latter precipitates almost the same amount of nitrogen as copper hydroxide, but the nitrogen is in part in different forms in the two precipitates. The author rejects both agents and employs the following process. The malt extract is first heated with steam for 1 hour under 1½ atmospheres pressure, the filtrate precipitated with zinc sulphate, and a little sulphuric acid. After filtering from the albumoses, the xanthine bases are separated by means of sodium hydrogen sulphate, copper sulphate, and barium chloride. The difference between the total nitrogen and nitrogen in the various precipitates gives the amidic nitrogen.

The coagulated proteids include the substances which settle when pasteurised beer is kept, and the less nitrogen beer contains in this form the more suited is it for pasteurisation and keeping. Beer contains 0·01 per cent. of xanthine bases. N. H. J. M.

[Ash of] Cardamoms. By H. B. Yardley (*Chem. News*, 1899, **79**, 122).—Cardamom seeds and husks have been found to yield

4·19 per cent. of ash, of a grey colour, containing per cent.: CaO, 13·33; Fe_2O_3, 0·51; Al_2O_3, 1·53; MgO, 4·52; Na_2O, 20·43; K_2O, 10·42; P_2O_5, 6·00; SO_3, 12·66; Cl, 2·54; SiO_2, 24·81; CO_2, C, &c., 4·40.

Herbert Bridges (*ibid.*, 154) and W. Watson Will (*ibid.*, 167) call attention to the presence af manganese in the ash. The latter has found in undoubted specimens of *Elettaria cardamomum* the ash (1) of the whole seeds to be 3·26, crushed 3.52; (2) of the pericarp of fruit, 5·96 and 6·17; of the entire fruit and seeds, 3·8 and 4·219 per cent. D. A. L.

Coffee. By L. A. Warnier (*Rec. Trav. Chim.*, 1899, **18**, 351—357). —The paper contains details of the complete proximate analysis of two types of Java coffee, *Coffea arabica* and *C. liberica*; the results are given in tabular form. The aqueous extract of coffee amounts to 30 per cent. of the whole; the quantity of free acid is very variable and diminishes rapidly when the berries are kept for a long time. Coffee berries contain about 15 per cent. of fatty substances, 1¼ per cent. of caffeine, and 4 per cent. of ash; the latter contains 75 per cent. of potash and 10 per cent. of phosphoric acid. G. T. M.

Composition of the Water-chesnut (Trapa Natans). By Paul Neumann (*Chem. Zeit.*, 1899, **23**, 22—23, 38—39).— The shells yielded 3·15 per cent. of ash, the composition of which is given; it is characterised by a high percentage of lime, magnesia, and potash, and by an unusual amount of iron and manganese. The composition of the fruit was as follows: water, 10·41; ash, 2·78; fat, 0·73; cellulose, 1·38; crude proteids, 19·93; dextrose, 3·22; starch, 52·19; other nitrogen-free substances, 9·36 per cent. A full analysis of the ash of the fruit is given; this differs from that of the shells by containing more phosphoric acid and potash. L. de K.

Action of Acetic Acid Vapour, and Dilute Acetic Acid on Plants. By G. Fassbender and A. Y. Grevillius (*Landw. Versuchs-Stat.*, 1899, **52**, 195—208).—Young oat plants were destroyed by being kept 4 hours in air containing 0·3—0·4 per cent. of acetic acid. Peas resisted the action of the acid better, whilst beans were only locally and temporarily affected by 0·5 per cent. of acid. Peas were killed by frequently watering the leaves with 0·05 per cent. acetic acid; beans were only injured by 0·5 per cent. acid, and the injury was mainly confined to portions to which drops of the acid adhered.

Water containing 0·001—0·01 per cent. of acid promoted the germinating energy of beans and peas, but the effect was less in the case of flax; no effect was observed with rye. Stronger solutions hindered germination (0·1 per cent. with flax, 0·2 per cent. with beans, peas, and rye). The germinating power of flax was influenced by 0·05 per cent. acid; with peas and rye, the percentage of seeds which germinated was only diminished by 0·2 per cent. acid. None of the seeds germinated in 0·5 per cent. solutions.

The growth of seedlings of peas and beans was promoted by dilute solutions (to 0·01 per cent.).

The points of the roots of seedlings are the parts most readily injured by acid. N. H. J. M.

Phosphoric Acid and Cereals. By CH. GUFFROY (*Bied. Centr.*, 1899, **28**, 573—574; from *J. Agric. prat.*, 1898, **62**, ii, 52).—Experiments were made with wheat and barley on poor soil (unmanured for at least 15 years). Phosphoric acid was applied in the form of basic slag (500 kilos. per hectare).

The effect of phosphoric acid was to increase the length, thickness, and strength of the straw, whilst the ears were better developed and the sp. gr. of the grain was increased. N. H. J. M.

Potash Requirements of Brewery Barley. By THEODOR RÉMY (*Ann. Agron.*, 1899, **25**, 397—398; from *Untersuch. Kalibedürf. d. Gerste. Berlin*, 1898).—The results of laboratory and field experiments made by the Berlin Institute of Brewing showed that potash is only effective in the case of soils poor in potash, that climatic conditions, especially the distribution of water, are of great importance, and that it is necessary, by careful tillage, to enable the soil to derive benefit from the manures. Under favourable conditions, the effect of potash is to increase the crop and the amount of starch, to diminish the amount of proteids, and to increase the weight of grain.

In accordance with Liebscher's observations, the lowest limit of potash soluble in 25 per cent. hydrochloric acid which a soil should contain is fixed at 0·15 per cent. Soils containing less than this amount will be benefited by manuring with potash. Application of potash to richer soils is to be avoided, as it increases the demand for other constituents without any benefit to the crop. N. H. J. M.

Valuation of Meadow Hay. By WOLDEMAR VON KNIERIEM, (*Bied. Centr.*, 1899, **28**, 526—527; from *Landw. Jahrb.*, 1898, Heft. 3—4).—Digestion experiments with rabbits gave the following results with different plants (percentage amounts digested):

	Crude protein.	Crude fat.	Crude fibre.	Non-nitrogenous substances.
White clover	68·2	50·9	57·35	83·07
Red clover	64·4	75·3	26·46	68·16
Kidney vetch	65·8	60·1	27·08	73·53
Vetch	71·27	58·03	29·87	69·23
Couch grass (luxuriant) ...	76·01	64·48	15·22	58·47
„ (poor)	71·79	63·06	12·37	59·40

Experiments with *Lotus corniculatus* and bastard clover failed, whilst *Lolium perenne* and *Phleum pratense* caused the rabbits to die at the conclusion of the experiment.

As regards the effect of sour hay on milk production, it was found that feeding with sour hay after clover hay at once caused a diminished production of milk, whilst a return to clover hay again raised the yield. Cows utilise sour hay better than sheep. N. H. J. M.

Tobacco Plant. By JOHANNES BEHRENS (*Landw. Versuchs.-Stat.*, 1899, **52**, 213—246. Compare Abstr., 1895, ii, 524).—The toughness and pliability of tobacco leaves cannot be due, as is frequently assumed, to the presence of substances allied to india-rubber or gum, as these cannot be detected in the leaves. The chief differences in composition between pliable and "dead" or brittle leaves are in the percentages of water and of substances soluble in water, both of which are higher in well-developed leaves. The composition of the soluble matter also differs, the amount of organic salts (mainly malate) being much higher in normal than in "dead" leaves; the normal leaves were found besides to contain more wax than brittle ones, and it is perhaps to this that their gloss is due. It was found that brittleness could be induced by covering portions of leaves with tinfoil. This is, however, only one cause of defective leaves; excessive manuring with Chili saltpetre produces leaves with lower percentages of soluble matter.

The liability to decay of tobacco from plants manured with nitrate and other soluble manures is attributed to the fact that the leaves take longer to dry, and to the danger of the drying process being stopped before the minimum amount of water required by the putrefying bacteria is reached. The leaves contain, moreover, more nutritive matter suitable for the bacteria than leaves of plants which have received no nitrate. N. H. J. M.

Importance of Chemical Analysis in Estimating the Value of Hops. By THEODOR RÉMY (*Bied. Centr.*, 1899, **28**, 563—568; from *Woch. Brauerei*, 1898, Nos. 41—43).—The chemical analysis of hops is not in itself sufficient for estimating their value, but may furnish useful information on a number of points. The amount of resin in hops is determined by extracting the ethereal extract with alcohol, evaporating carefully, and drying the residue at 60° under 1/10th atmospheric pressure. The results of a number of analyses showed that whilst samples of good quality contained 18·5—22·8 per cent. of resin in the dry matter, inferior samples contained only 14·0—17·4 per cent. The percentage of resin does not seem to vary much in hops from different districts.

The portion of the resin soluble in light petroleum (soft resin) is, according to Hayduck, Briant, and Meacham, the substance to which the preserving and bitter qualities of hops are due. Determinations of soft resin in hops from different districts gave results varying from 9·5—17·0 per cent. in dry matter. The amount of soft resin depends, not only on the amount of total resin, but is influenced by the methods of drying, storing, &c.

The determination of tannin in hops seems to be of little use in estimating the value of hops, whilst the total nitrogen and the soluble nitrogen give no indications at all.

The amounts of potash and phosphoric acid in hops were found to be 1·85—3·75 and 1·02—1·63 per cent. in the dry matter respectively.

N. H. J. M.

Linseed in its Botanical, Chemical, and Agricultural Relations. By AL. HERZOG (*Bied. Centr.*, 1899, **28**, 544—545; from *Publ. Versuchs-Stat., Flachsbau Trautenau*, No. 3).—Linseed contains, on the average, water, 7·5; crude protein, 23; crude fat, 35; nitrogen-free extract, 22·2; crude fibre, 8·8, and ash, 3·5 per cent. The pure ash contains K_2O, 28·41; MgO, 13; and P_2O_5, 44 per cent.

During the growth of the plant oil migrates from the leaves to the seeds, where it is first transformed into starch. Subsequently (chiefly between the periods of flowering and ripening) the starch is transformed again into oil. According to Schischkin, the amount of oil in the seeds is influenced by manuring. N. H. J. M.

Composition of Walnut-cake. By B. FALLOT (*Bied. Centr.*, 1899, **28**, 531—532; from *J. d'agric. prat.*, 1898, 628).—The percentage composition of walnut-cake prepared by the cold (1) and by the hot processes (2—4) was found to be as follows:

	Water.	Proteids.	Fat.	N.-free extract.	Crude fibre.	Ash.	K_2O.	P_2O_5.
1. Cold process	9·40	31·79	27·17	20·61	6·83	4·20	0·87	1·77
2. Hot ,, (max.)	15·04	44·87	20·06	33·62	9·01	5·27	1·59	2·40
3. ,, ,, (min.)	4·11	29·29	9·26	21·96	3·11	4·36	1·27	0·40
4. ,, ,, (av.)	11·40	37·77	13·68	27·75	4·56	4·77	1·39	1·71

As a concentrated food only to be used in conjunction with other foods, the composition of walnut-cake is very favourable. The following ration for cows was found to be very suitable; walnut-cake (1·5), green maize (15·0), sugar beet (15·0), and oat, chaff, and straw (5 kilograms). N. H. J. M.

Experiments on Rape. By WILHELM GRASHOF (*Chem. Centr.*, 1899, i, 858; from *J. Landw.*, **47**, 85—90).—The experiments were conducted in large zinc cylinders filled with soils of different kinds and differently manured. Both the nature of the soil and of the manure influenced the amount of oil in the produce. Phosphatic manure increased the percentage of oil rather more than 2 per cent. When the percentage of oil in rape is high, the nitrogen is low, whilst with a high percentage of nitrogen there is less oil. N. H. J. M.

Volatile Mustard Oils [Thiocarbimides] in different Rape Cakes. By GUNNER JÖRGENSEN (*Landw. Versuchs-Stat.*, 1899, **52**, 269—290. Compare this vol., ii, 46).—The seeds of *Camelina sativa*, *Eruca*, *Erysinum orientale*, *Sinapis arvensis*, and *S. dissecta* do not give off volatile thiocarbimide. The Indian seeds of *Brassica dichotoma*, *B. glauca*, *B. juncea*, *B. ramosa*, and the seeds of *B. napus*, *B. Rapa*, and *B. campestris* all yielded volatile thiocarbimide, but in the case of the first two and last three the odour is only slight, and does not last long.

Several different cakes were examined, the amount of thiocarbimide, the nitrogen as thiosinamine, and the melting point of the thiosinamine being determined when crystalline. It was found that all cakes which contained much rape, or seeds which do not yield volatile thiocarbimide, gave low percentages of thiocarbimide, whilst in the case of *B. Rapa* and Indian seeds the yield was decidedly higher. The determination of the thiocarbimide alone is, however, not sufficient to decide the suitability or unsuitability of a sample of cake for cattle feeding. When, however, two cakes contain the same amount of nitrogen as thiosinamine, the one which gives the larger proportion of thiocarbimide is almost sure to be the more injurious as cattle food.

As regards the percentage of nitrogen as thiosinamine, the amount required for the allyl compound (24·14 per cent.) was never reached.

Four samples, of which three were injurious, gave results very near to 22·6 per cent., whilst the nitrogen of the others was always below 22 per cent.

The melting points of these thiosinamines which crystallised showed no relation to the composition; in cases where the percentage of nitrogen was about 22·6, the thiosinamines never crystallised.

N. H. J. M.

Decomposition of Feldspar Rocks by Roots. By FAUSTO SESTINI (*Ann. Agron.*, 1899, **25**, 399—400; from *Bull. Soc. Chim.*, [iii], **21**, 515).—Gramineous plants were grown in a pot containing feldspar sand, whilst a second pot of the same sand was left without vegetation. At the end of the experiment, it was found that the pot with vegetation contained 33·5 grams of fine soil (containing 4·02 per cent. of clay), whilst the second pot contained only 14·99 grams of fine soil (containing 1·05 per cent. of clay). It is probable that microbes and algæ exercise a similar effect. It is evident therefore that biological as well as physical action is of importance in the production of soil from rocks (compare Müntz, Abstr., 1887, 1135, and 1890, 1183).

N. H. J. M.

Forms of Phosphoric Acid in Peaty Soil. By G. NANNES (*Chem. Centr.*, 1899, i, 856—857; from *J. Landw.*, **47**, 45—48).—The soil examined was well decomposed peat soil from Kalmar (Sweden), and contained: organic matter, 82·3; N, 2·66; CaO, 1·36, and P_2O_5, 0·38 per cent. Lecithin and chlorophyllan were only present in traces. Extraction with 2 per cent. hydrochloric acid yielded 0·05 per cent. of free phosphoric acid, but no phosphoric acid in organic compounds. Subsequent extraction with 10 per cent. ammonia dissolved 0·13 per cent. P_2O_5, of which 0·098 was precipitated with humus on adding hydrochloric acid. Direct extraction with ammonia (without previous acid extraction) gave 0·05 per cent. P_2O_5 as free acid, and 0·133 per cent. in humus. All the percentage results refer to the original soil.

Treatment with nitric acid and precipitation of the filtrate with lead acetate yielded a substance rich in phosphoric acid. N. H. J. M.

Solubility of the Phosphoric Acid of Surface Soil and Subsoil. By JOSEF SEISSL (*Chem. Centr.*, 1899, i, 1136; from *Zeit. landw. Versuchswesen. Österr.*, 1899, **2**, 120—134).—Phosphoric acid, total and soluble in citric acid (Maercker's method), lime, and sesquioxides were determined in a number of soil samples. In most cases, the surface soil was poorer in lime and sesquioxides than the subsoil, and it is concluded that the relation between phosphoric acid and sesquioxides is closer in the former than in the latter. The solubility of phosphoric acid is mainly influenced by the sesquioxides and organic matter, and also to some extent by the amount of lime.

Similar results were obtained with the coarser particles of soil (2—3 mm. sieve), but the amount of total phosphoric acid was so small that it is proposed, in soil analysis, to use only the fine soil (1 mm. sieve).

N. H. J. M.

The Franzenbad Mineral Peat Soil. By ERNST LUDWIG, CARL HÖDLMOSER, and THEODOR PANZER (*Chem. Centr.*, 1899, i, 1221—1223; from *Wien. klin. Woch.*, **12**, 463—468).—The humus dissolved from the soil by alkali and precipitated by acid contained C, 58·38 ; H, 3·78 ; N, 2·1, and ash, 1·75 per cent. When distilled with steam, the soil yielded small amounts of formic and higher fatty acids. The aqueous extract of the weathered soil was strongly acid, and contained free sulphuric acid, whilst that of unexposed soil was neutral or slightly acid. The soil contains considerable amounts of pentosans.

The soil which has been long exposed to air is employed for baths, and contains much iron sulphate ; in soil which has not been exposed, the iron is present as sulphide. Experiments made by Landsteiner indicate that the reduction of sulphates in peat soil is due to microbes.

Analyses of a number of samples of the soil are given.

N. H. J. M.

Soil of Bad-Pyrmont. By Ulrich Kreusler (*Zeit. anal. Chem.*, 1899, **28**, 411—429).—The soil contains more or less partly decomposed vegetable matter derived from marsh-plants, as well as the remains of roots and branches of woody plants. The absence of the specific peat-moss indicates the character of "meadow-moor" as opposed to peat-producing moorland. The soil is similar to that of Franzenbad and Marienbad.

The dry soil (1) not weathered, and (2) weathered, was found to contain the following percentage amounts of organic matter, &c.

	Soluble in water.			Not dissolved by water.					
	Ammonia.	Formic acid.	Humic acids.	Ammonia.	Humic acids.	Humin.	Wax.	Resin.	N.
1.	0·0095	0·0584	0·9085	0·0228	16·8195	13·2983	1·3080	0·3480	2·238
2.	0·0464	trace	1·7575	0·0183	17·0875	7·8700	1·0260	0·6610	1·562

The dry soil contained (1) 14·5144, and (2) 20·2850 per cent. of mineral matter soluble in hot hydrochloric acid of sp. gr. 1·15, and 22·8847 and 29·5624 per cent. of insoluble mineral matter. Complete analyses of the soluble (in water and in acid) and insoluble mineral matter are given for both soils. The chief differences in the amounts of substances soluble in water in the two samples are :—Ferric sulphate (1, trace ; 2, 1·647), ferrous sulphate (1, 1·083 ; 2, 1·885), aluminium sulphate (1, 0·083 ; 2, 1·165), and free sulphuric acid (as SO_3, 1, 0·214 ; 2, 0·992).

N. H. J. M.

Occurrence of Perchlorate in Chili Saltpetre. Injurious Action on Cereals and Sugar Beet. By Al. J. Zaharia (*Bied. Centr.*, 1899, **28**, 511—516 ; from *Bul. Soc. Sci. Bucarest*, 1898, 361. Compare this vol., ii, 513).—The examination of 206 samples of Chili saltpetre at Halle showed that one sample contained 5—6, one 3—4, three 2—3, eleven 1·5—2 per cent. of perchlorate ; whilst thirty-nine samples contained 1—1·5, and the rest (151) less than 1 per cent. of perchlorate.

Solutions containing 0·05—0·1 per cent. of perchlorate were found to have no effect on the germination of sugar beet, rye, and wheat, and practically no effect on barley, but a slight effect was observed in the case of oats. Even 1 per cent. solutions had very little effect on the germination of wheat.

As regards the influence of perchlorate on the development of seedlings, oats were most affected, then rye, wheat, and, least of all, barley. A 0·001 per cent. solution had no effect on barley and wheat, but had a distinct effect on oats and rye.

The results of experiments with oats in different soils show that with Chili saltpetre containing 1 per cent. of perchlorate, the decrease of grain and straw amounted to 4 per cent. With 2 per cent. of perchlorate, the decrease in grain may be as much as 25 per cent., whilst the effect on straw production is less marked.

Sugar beet is much less affected by perchlorate than oats, and the effect may be only temporary. Even nitrate containing 6 per cent. of perchlorate will not destroy a crop of sugar beet, although it will diminish the yield of roots; nitrate containing 2 per cent. of perchlorate is not injurious, and when only 1 per cent. is present the perchlorate is even beneficial, giving an increased percentage of sugar and a somewhat higher purity coefficient. N. H. J. M.

Denitrification and Farmyard Manure. By Robert Warington (*J. Roy. Agr. Soc. Eng.*, 1897, [iii], **8**, 577—607).—After discussing the results of the various investigations on the subject of denitrification, and the recent results of the pot experiments of Wagner and Maercker indicating that the destruction of nitrates in the soil is the chief cause of unsatisfactory results obtained after application of dung, some results of Rothamsted experiments bearing on the question are described.

In experiments with mangel-wurzel during the six years 1878—1883, it is shown that when sodium nitrate, or ammonium salts, were applied in conjunction with superphosphate, the increase in the quantity of nitrogen in the roots, due to the nitrogenous manures, was practically the same as when they were applied in conjunction with farmyard manure (14 tons per acre per annum). The farmyard manure had therefore no depressing effect on the action of the nitrate or ammonia. This conclusion still holds good if the nitrogen of the leaves, which are returned to the land, is taken into account, since the production of the leaf is greatest on the dung plot. In more recent years, since the nitrate has been applied as a top-dressing in July, instead of being applied before the dung, the effect of nitrate in presence of farmyard manure was still greater.

Sodium nitrate and ammonium salts have a greater effect on the yield of roots without than with farmyard manure, but the increase is much less nitrogenous.

With regard to the effect of straw, further Rothamsted experiments with wheat and on permanent meadow are described, in which considerable amounts of wheat straw were applied with ammonium salts. The results do not bear out the conclusion that straw is injurious in promoting denitrification.

When very large amounts of dung are employed, as in horticulture, the danger of considerable loss of nitrogen will increase with the quantity of fermentable organic matter, and will be much aggravated by a wet condition of the land. N. H. J. M.

Losses of the Nitrogen [of Farmyard Manure] in the Free State. By Pierre P. Dehérain and Dupont (*Ann. Agron.*, 1898, **25**, 401—420).—Aërobic and anaërobic fermentation experiments with farmyard manure are described, in which weighed quantities of the manure (about 1 lb.) were kept in flasks through which air or carbonic anhydride was passed. The differences in the amounts of nitrogen in different forms before and after the experiment were ascertained, and in some cases the amounts of methane and hydrogen produced were determined.

It is concluded that whilst, as in Schlœsing's experiments (Abstr., 1892, 1123), farmyard manure may ferment for several weeks without liberation of free nitrogen, other conditions may prevail under which nitrogen is eliminated. Slow fermentation, in which hydrogen as well as methane is produced, seems to be favourable to loss of nitrogen; when the fermentation is vigorous, carbonic anhydride and methane, without hydrogen or free nitrogen, are given off. To induce this vigorous fermentation, the manure must be rendered very alkaline by addition of liquid manure, and must, besides, be frequently watered. This prevents loss of ammonia, as well as of nitrogen, in the free state. Further experiments with the object of confirming this important conclusion are in progress. N. H. J. M.

Production of Citrate-soluble Phosphate. By H. Knoop (*Bied. Centr.*, 1899, **28**, 516—517; from *Zeit. angew. Chem.*, 1899, 66).—The process consists in heating phosphorite, bones, &c., mixed with silicates of the alkalis (in the form of broken glass, &c.) and alkaline earths at a yellow-white heat. In the case of phosphorites containing a high percentage of phosphorus, the amounts employed are alkaline earth silicates (60) and alkali silicates (30 parts) to 100 of phosphorite. When potassium silicate is employed, the amount should be somewhat increased, and when much magnesia is present less silicate should be employed. With glass as the silicate, an addition of calcium carbonate is desirable to obtain the suitable relation of silicic acid and bases.

The fusion may be conducted in Siemens furnaces, and there is no danger of loss of phosphoric acid at high temperatures. Two mixtures of phosphorite, with chalk, sand, and sulphate, yielded products having a citrate solubility of 99 per cent. N. H. J. M.

Analytical Chemistry.

Asbestos Filters. By Otto Lohse (*Ber.*, 1899, **32**, 2142—2146).—The author describes a modified asbestos filter tube constructed on the same principle as a Gooch filter (*Chem. News*, 1878, **37**, 181). It consists of a glass tube, 12 cm. long and 15 mm. in diameter, closed at one end and slightly widened at the open end; the closed end is perforated with a number of minute holes, so arranged that the tube can be heated without risk of breaking. The advantage the tube appears to have over the ordinary Gooch filter is that the precipitate can be somewhat more conveniently heated in a reducing atmosphere.

Convenient forms of aluminium holder, desiccator, and tongs for removing the asbestos from the tube, are also described. J. J. S.

Weighing Corrosive or Fuming Liquids. By RUDOLF SCHWARTZ (*Chem. Zeit.*, 1899, **23**, 451).—The apparatus is essentially a pipette, ending in two capillary tubes, and weighing about 2—3 grams. One end is placed in the liquid, and suction is applied at the other end with a pump until the bulb is three parts filled; the top tube is then sealed. By removing the pipette and turning it upside down, it becomes possible to seal the other end, and the pipette is then reweighed. The pipette may be readily broken under water to obtain the required solution. L. DE K.

Apparatus for the Extraction of Liquids with Ether. By FRITZ BAUM (*Chem. Zeit.*, 1899, **23**, 249—250).—Ether is boiled in a flask, and the vapour being condensed, the ether (or similar non-miscible solvent) flows down the condenser tube to the bottom of a cylindrical vessel containing the liquid (or solid matter) to be extracted. While ascending through the liquid, it dissolves any fatty matter, and when a certain quantity has collected on the top it is syphoned back into the boiling flask. An illustration is given.

When the liquid has been thoroughly extracted, it is removed with a pipette, thus leaving plenty of room for the collection of the recovered ether. L. DE K.

Estimation of some Inorganic and Organic Acids by means of the Volume of Hydrogen evolved on Treatment with a Metal. By KARL ULSCH (*Chem. Zeit.*, 1899, **23**, 624—625).—Platinised iron (iron powder treated with solution of platinum chloride) is quantitatively acted on by fairly concentrated solutions of sulphuric, hydrochloric, and phosphoric acids, and the amount of these acids may be readily ascertained from the volume of hydrogen evolved. Phosphoric acid causes some trouble as the platinised iron gets gradually coated with ferrous phosphate.

The process may also be extended to the estimation of oxalic, acetic, and lactic acids; the author has not, as yet, applied it successfully to tartaric and citric acid (compare this vol., i, 868). L. DE K.

Iodometric Acidimetry. By FRANZ FESSEL (*Zeit. anal. Chem.*, 1899, **38**, 449—453; from *Inaug. Dissert. Tech. Inst. Univ. Würzburg*, 1898).—The author has submitted to a careful study the conditions under which the reaction $KIO_3 + 5KI + 6HCl = 6KCl + 3H_2O + 6I$ can be employed for the estimation of a free acid. It is important that both the iodate and the iodide should be in excess, otherwise too little thiosulphate will be required. A deficiency of the former will be indicated by a liberation of iodine on adding iodate to the colourless liquid at the end of the titration. A deficiency of the latter is shown by the deposition of solid iodine.

Boiled water must be used, since carbonic anhydride liberates iodine from the mixture of iodide and iodate. The iodide solution (10 per cent.) should be preserved from air and light, but even if coloured by free iodine it may be used after decolorising with thiosulphate. Excessive dilution lowers the results, but as this seems to be due to a retardation of the reaction, it is recommended that where great dilution is unavoidable there should be a delay of half an hour before titrating the liberated iodine. The method cannot be employed for organic acids.

J. Kjeldahl points out that, in applying the iodometric method to the estimation of ammonia, accurate results are only obtained by working strictly in the same manner in all cases. Sulphuric acid either alone or after absorption of ammonia does not immediately liberate the theoretical amount of iodine from a mixture of iodide and iodate, but the deficiency in the quantity of thiosulphate required will be the same in the two cases if the volumes of the solutions are equal. The thiosulphate should be standardised by titrating with it the acid to be employed both before and after the absorption of ammonia from a known weight of an ammonium salt. M. J. S.

Delicate Reaction of Hydrogen Peroxide. By Edgar S. Barralet (*Chem. News*, 1899, **79**, 136).—Ferrous ferrocyanide, prepared from a solution of a ferrous salt and potassium ferrocyanide, is quickly turned deep blue by hydrogen peroxide, even when the amount of the latter is as little as 1 part in 165,000 parts of water.

D. A. L.

Estimation of Hydrochloric Acid in the Stomach Contents. By Giuseppe Siringo (*Gazzetta*, 1899, **29**, i, 476—479).—The author finds that the use of Günzberg's reagent—an alcoholic solution of phloroglucinol and vanillin (Abstr., 1888, 617)—does not afford an infallible test for the presence of hydrochloric acid in the stomach contents, and suggests instead the employment of salts of nitrohydroxylamine which even in very dilute solutions are decomposed by hydrochloric and the other more energetic acids, nitric oxide being immediately evolved in almost theoretical quantity; the weak organic acids, as also acid phosphates, are without effect. 5 c.c. of the stomach contents are placed in a graduated tube which is filled with mercury and inverted in a mercury trough; a small piece of the nitrohydroxylamine salt, for instance, the sodium salt, is then introduced into the tube and after a few minutes the volume of the evolved gas is read off and corrected in the usual way. T. H. P.

Estimation of Chlorine, Bromine, and Iodine. By J. Bougault (*J. Pharm.*, 1899, [vi], **10**, 18—20).—Instead of converting the mixed silver haloids into silver chloride, they are reduced by pure metallic zinc and dilute sulphuric acid (1 of acid to 10 of water), and the precipitated metallic silver weighed. The reduction takes place easily and the results obtained are accurate. H. R. Le S.

Detection of Chlorates, Bromates, and Iodates in the Presence of Each Other. By Dioscoride Vitali (*Chem. Centr.*, 1899, i, 1083—1084; from *Boll. Chim. Farm.*, **38**, 201—209).—When manganous sulphate is treated with sulphuric acid and potassium bromate, a violet-red solution is obtained; this coloration is not due to permanganic acid, but to a manganic salt. Chlorates or iodates do not give this reaction. On boiling, the manganese is completely precipitated as hydrated dioxide.

Salts of hydroxylamine (but not the free base) act on iodates in the cold with liberation of iodine; bromates are only reduced on heating, and chlorates are not affected at all; salts of phenylhydrazine act similarly. Phosphorous and hypophosphorous acids do not act on bromates or chlorates, but in contact with iodates, iodine is first liberated, and then redissolved as hydriodic acid. The author recommends the following process for the separation of the three compounds. By cautious addition of silver nitrate, the iodates and bromates are alone precipitated; the silver compounds are then decomposed with hydrogen sulphide, and after filtering from the silver sulphide, the excess of the former is expelled by gentle warming, and the filtrate neutralised with soda and concentrated. The iodine is liberated by means of sulphuric acid and potassium nitrite, and removed by shaking with chloroform; the liquid is then tested for bromine with chlorine water. L. DE K.

[Detection and Estimation of Small Amounts of Iodine in Cuprite and Malachite.] By WILHELM AUTENRIETH (*Chem. Zeit.*, 1899, **23**, 626—627).—The finely divided mineral is fused with 3—4 times its weight of pure sodium hydroxide (from metal) and a small quantity of water in a nickel crucible; the mass is then extracted with water, the filtered solution transferred to a glass cylinder and mixed with 10—20 c.c. of chloroform, a few drops of a 1 per cent. solution of pure sodium nitrite solution, and then acidified, while well cooled, with 20 per cent. sulphuric acid; after vigorous shaking, the colour of the chloroform solution is compared with that produced by the addition of a known quantity of potassium iodide solution (0·0001 gram iodine in 1 c.c.) to 20 c.c. chloroform, several c.c. of saturated sodium sulphate solution, dilute sulphuric acid, and a little sodium nitrite solution. The results are correct to within 0·1 milligram of iodine. If siliceous ores are present in the mineral, it is necessary to filter after fusing and rendering acid with sulphuric acid. The fusion must not be carried out at too high a temperature, as in such circumstances the sodium iodide volatilises. J. J. S.

Detection of Fluorine in Wine. By GIULIO PARIS (*Chem. Zeit.*, 1899, **23**, 685—686).—The ash obtained from 50 c.c. of wine is mixed with a little precipitated silicic acid, introduced into a platinum crucible, and 0·5—1 c.c. of sulphuric acid added. The crucible is then covered with an inverted lid containing cold water, the under side being also moistened with a drop of water. The mixture is now heated over a very small flame for 5 minutes, and when cold the drop of liquid adhering to the lid is put on to a slide covered with a thin layer of Canada balsam, and a few particles of sodium chloride are added. After about an hour, the slide is examined under the microscope for the very characteristic crystals of sodium silicofluoride.

L. DE K.

Estimation of Sulphur in Iron, Iron Pyrites, Slags, Coal, Coke, Asphalt, Rubber, and Gas Purification Material. By OTTO HERTING (*Chem. Zeit.*, 1899, **23**, 768—769).—Mainly a review of recent improved methods for the estimation of sulphur in these materials.

The use of stannous chloride for reducing ferric sulphate before precipitating with barium chloride is suggested. L. DE K.

Estimation of Sulphuric Acid in the Presence of Iron. By Georg Lunge (*Zeit. anorg. Chem.*, 1899, **21**, 194—200).—An answer to Küster and Thiel (this vol., ii, 247).—A comparison of the results obtained in the estimation of sulphur in iron pyrites by the author's and Küster and Thiel's methods shows that there is no practical difference in the results obtained, being 49·93 per cent. and 49·86 per cent. respectively, and the time employed on each method is about equal. In the estimation of sulphur in pyrites residues, the results obtained by the different methods are as follows: Watson-Lunge, 1·96 per cent.; Meineke's, by fusion with sodium carbonate and potassium chlorate, 2·00 per cent.; Lunge's ammonia method, 1·94 per cent.; Küster and Thiel's, 1·94 per cent.; Meineke's, by reduction with zinc (this vol., ii, 518), 1·92 per cent. E. C. R.

Valuation of Persulphates. By G. H. Mondolfo (*Chem. Zeit.*, 1899, **23**, 699).—2 or 3 grams of the sample are dissolved in 100 c.c. of cold water, and 10 c.c. then heated at 60—80° in a stoppered bottle with half a gram of potassium iodide for 10 minutes. The liberated iodine is titrated with $N/10$ sodium thiosulphate, 1 c.c. of which represents 0·0114 gram of ammonium, or 0·0135 gram of potassium persulphate. L. de K.

Gas Washing Apparatus. By Otto Foerster (*Chem. Zeit.*, 1899, **23**, 196—197).—The apparatus is based on the principle of the dephlegmator used in fractional distillation. The steam evolved when boiling a solution of an ammonium salt (such as a reduced nitrate) with excess of alkali, partly condenses, and when a certain quantity of liquid has accumulated, it is syphoned back into the boiling flask. By this means, the liquid cannot become over concentrated whilst the ammonia is still fully expelled. Two drawings are given. L. de K.

The Diphenylamine Test for Nitric Acid in Natural Waters. By Raffaele Cimmino (*Zeit. anal. Chem.*, 1899, **38**, 429—431).—The sensitiveness of this test depends greatly on the mode of performing it. That recommended by Emmerich and Trillich has hitherto been the most sensitive, being capable of detecting nitric acid at a dilution of 1 : 100,000, but by the addition of a little hydrochloric acid the sensitiveness is increased tenfold. The reagent employed therefore is a solution of diphenylamine and sulphuric acid in 5 per cent. hydrochloric acid; three or four drops of this reagent are added to 1 c.c. of the liquid to be tested, then 2 c.c. of concentrated sulphuric acid, and the whole shaken. In presence of nitric acid, the mixture acquires a blue colour. No other constituent of natural water gives a similar reaction. M. J. S.

Estimation of Ammonia and Nitric and Nitrous Acids in Natural Waters. By Ludwig W. Winkler (*Chem. Zeit.*, 1899, **23**, 454—455; 541).—Preformed ammonia may be estimated without previous distillation by removing the calcium and magnesium salts by means of sodium hydroxide and carbonate; the clarified solution may then be at once Nesslerised. If too little standard ammonia has been added to the comparison liquid, it does not do to add a little more, but a fresh solution must be prepared. To obviate this, and also to save the removal of the calcium and magnesium salts, the author recommends the addition of a soluble tartrate (Rochelle salt) both to the water and to the comparison liquid.*

The ordinary Nessler solution is not well adapted to this process, but a delicate solution may be prepared by dissolving 10 grams of mercuric iodide and 5 grams of potassium iodide in a little water, and then adding a solution of 20 grams of sodium hydroxide, and finally diluting to 100 c.c.

For the estimation of nitric acid, a slight modification of Lunge and Lwoff's process is recommended (Abstr., 1894, ii, 398). Nitrous acid is estimated by the amount of iodine liberated by the addition of hydrochloric acid and potassium iodide; the liquid is then titrated with standard solution of sodium thiosulphate, using starch-water as indicator. To get trustworthy results, the air should be excluded, which is best effected by operating in a sufficiently small flask with narrow neck, and displacing the air by carbonic anhydride generated by dropping into the acid liquid a sufficiency of solid potassium hydrogen carbonate. L. de K.

A Source of Error in the Estimation of Nitric Nitrogen by Ulsch's Method. By L. Brandt (*Chem. Zeit.*, 1899, **23**, 22).—Ulsch (Abstr., 1891, ii, 617) reduces nitrates to ammonia by the action of sulphuric acid and reduced iron. The author shows the necessity of always making a blank experiment to ascertain whether the reagents are free from nitrogen. In one case, it was found that the iron used in the experiment contained a considerable amount of nitrogen in some form capable of conversion into ammonia when the metal was dissolved in dilute sulphuric acid. L. de K.

Gasometric Estimation of Nitric Oxide. By Georg von Knorre and Kurt Arndt (*Ber.*, 1899, **32**, 2136—2141).—As the usual methods for the estimation of nitric oxide, namely, (1) absorption by solution of a ferrous salt; (2) titration with potassium permanganate; (3) conversion into nitric peroxide by the aid of oxygen, are considered unsatisfactory, the authors have elaborated another method which consists in passing the gas, together with an excess of hydrogen, through a Drehschmidt's platinum capillary tube heated to bright redness and measuring the contraction. According to the equation $2NO$ (2 vols.) $+ 2H_2$ (2 vols.) $= N_2$ (1 vol.) $+ 2H_2O$, the amount of nitric oxide is equal to 2/3 of the contraction. Very good results have been obtained by this method, but it is absolutely necessary that the mixed gases should pass very slowly through the capillary, as otherwise a certain amount of ammonia is formed. The method also admits of the estimation of nitrous oxide in the presence of nitric oxide. From the equation N_2O (1 vol.) $+ H_2$ (1 vol.) $=$ N_2 (1 vol.) $+ H_2O$ and the one given above, it follows that if $x =$ vol. of nitric oxide and $y =$ vol. of nitrous oxide, then $x + y = V$ (volume of mixture), $1{\cdot}5\,x + y = C$ (contraction on leading through the capillary, and $x = 2(C - V)$.

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* Note by Abstractor.—Romijn (*Ber. Deut. Pharm. Ges.*, 1898, **8**, 9) has already advocated the use of Rochelle salt.

If nitrogen is present in addition to nitrous and nitric oxides, then the amount of hydrogen used up must be determined, and the volumes of the three constituents can be calculated. J. J. S.

Detection and Estimation of Free Phosphorus in Oils and Fats. By Émile Louïse (*Compt. rend.*, 1899, **129**, 394—395).—When a solution of silver nitrate is added to a solution of phosphorus in oil, the silver solution is reduced, and a black precipitate is produced as long as any free phosphorus is present. By previously mixing the oil with 20 times its volume of acetone, the production of any turbidity is prevented when the aqueous silver nitrate solution is added. A 10 per cent. and a 1 per cent. solution of silver nitrate are prepared, and these titrated by taking 5 grams of oil, containing a known quantity of phosphorus, and diluting to 100 c.c. with acetone. To 10 c.c. of this solution, the 10 per cent. silver nitrate solution is added drop by drop until the filtered liquid is no longer darkened in colour on the addition of another drop of silver nitrate. Suppose two drops of the silver nitrate solution were insufficient, but that after the addition of three drops the filtered liquid was not darkened on the addition of another drop, then evidently the correct amount of silver nitrate solution was between two and three drops. To determine the exact amount, another 10 c.c. of the solution are taken, two drops of the 10 per cent. solution added, the liquid filtered, and then the 1 per cent. solution added drop by drop until the filtered liquid is not darkened in colour by the further addition of silver nitrate. In this way, the strengths of the silver solutions in terms of phosphorus are ascertained. The determination of an unknown amount of phosphorus in an oil is carried out in exactly the same way. To obtain drops of exactly the same size, Duclaux's apparatus was used. H. R. Le S.

Limits of Error in the Estimation of Phosphoric Acid Soluble in Citric Acid. By Max Maercker (*Landw. Versuchs-Stat.*, 1899, **52**, 119—136).—A Report to the Verband der Versuchs-Stationen on the results of two series of determinations of phosphoric acid soluble in citric acid in samples of basic slag, the first comprising 468 analyses of 116 samples, the second 504 analyses of 252 examples.

In the second series of determinations, 92·1 per cent. showed a difference of, at most, 0·5 per cent. between the highest and the lowest result, or an error of ±0·25 per cent. N. H. J. M.

Estimation of Total Phosphoric Acid in Basic Slags. By C. Aschman (*Chem. Zeit.*, 1899, **23**, 435—436).—The following solutions are required: nitrosulphuric acid, made by taking 420 grams of nitric acid of sp. gr. 1·2, 50 grams of strong sulphuric acid, and diluting with water to 10 litres. Solution of citric acid, made by dissolving 500 grams of the acid to 1 litre. Wagner's magnesia mixture, made by dissolving 110 grams of crystallised magnesium chloride and 140 grams of ammonium chloride in 700 c.c. of ammonia (of 8 per cent. strength) and 1300 c.c. of water. Molybdate solution, made by dissolving 150 grams of ammonium molybdate and 400 grams of ammonium nitrate to 1 litre, and pouring the solution into a litre of nitric acid of sp. gr. 1·19.

5 grams of the sample are put into a half-litre shaking bottle, which is then filled up to the mark with nitrosulphuric acid. After rotating for half an hour in a Wagner apparatus, the liquid is left overnight. 50 c.c. of the filtrate are then mixed with 10 c.c. of citric acid solution and neutralised with ammonia; 50 c.c. more water are added, and the whole left to cool for 20 minutes. To the liquid, which must be perfectly clear, are now added 20 c.c. of magnesia mixture; after a few hours standing with frequent stirring, the magnesium phosphate precipitate is collected as usual.

If the neutralised liquid deposits silicic acid, another portion of the acid solution must be precipitated with molybdate in the usual manner. L. DE K.

Basic Slag. By ARMAND DEZSÖ HERZFELDER (*Landw. Versuchs-Stat.*, 1899, **52**, 291—314. Compare Abstr., 1897, ii, 344).—The assimilable phosphoric acid in basic slag is in the form of tricalcium phosphate. The slag contains also calcium phosphates of higher basicity, iron phosphates, iron silicophosphates, calcium silicophosphates, calcium oxide and carbonate, silicon chiefly in combination with calcium, iron oxide, sulphide, and carbonate, &c.

The difficulties in the way of determining the tricalcium phosphate by extraction with citric acid are the presence of lime, which neutralises some of the acid, and the dissolution of a portion of the silicate, most of which is precipitated with the molybdate, redissolves in ammonia, and is again precipitated by the magnesia mixture. In this way, 0·01 and 0·02 gram of SiO_2 will cause an error of 0·6 and 1·27 per cent. in the phosphoric acid. This source of error and the error (in the other direction) caused by the presence of lime, can be avoided by altering the process, but the presence of iron in the slag involves another difficulty, since iron compounds diminish the solubility of tricalcium phosphate in citric acid.

It is concluded that the error of the Wagner method is as much as 2—3 per cent., and varies according to the nature of the slag. With slags which do not contain much total phosphoric acid and silica, relatively little soluble phosphoric acid, but much lime and iron, the results will be too low; whilst with slags which contain much phosphoric acid (both total and soluble) and silica, but only a little lime and iron, the results for soluble phosphoric acid may be even higher than the total phosphoric acid. N. H. J. M.

Estimation of Boric Anhydride in Boracite. By RUDOLF SCHWARTZ (*Chem. Zeit.*, 1899, 497).—Gilbert's process of carefully estimating the other constituents of the mineral and thus obtaining the boric anhydride by difference is difficult of application. Hönig and Spitz's volumetric process yields very good results. In order to prepare the solution for titration, 1—2 grams of the finely powdered sample are digested for several hours with 100 c.c. of water, and 5—10 c.c. of hydrochloric acid; if a reflux apparatus is employed, half-an-hour's heating on the water-bath will be sufficient. The filtrate is carefully neutralised with *N*/5 soda, using methyl-orange as indicator. The solution may also be prepared by attacking the mineral suspended in water with carbonic anhydride for about half-an-hour;

after remaining for a few hours in a closed flask, the liquid is filtered, evaporated to about 20 c.c., and carefully neutralised with dilute hydrochloric acid, using methyl-orange as indicator; the carbonic anhydride is then expelled by boiling for a short time. The liquid obtained in either way is then titrated with *N*/5 soda in the presence of glycerol, using phenolphthalein as indicator (Abstr., 1897, ii, 159).
L. DE K.

Estimation of Carbon in Iron Products. By ADOLPHE CARNOT and E. GOUTAL (*Chem. Centr.*, 1899, i, 903; from *Anal. Chim. Appl.*, **4**, 73—76).—Blair separates carbon from iron by treating the sample with a solution of potassium cuprous chloride containing 15 c.c. of hydrochloric acid in 200 c.c. The authors having tested the method, state that the temperature should not exceed 70°, otherwise there will be a loss of carbon. They, however, prefer their own process of treating the sample at 95° with the slightly acidified copper solution for about half-an-hour in a current of carbonic anhydride. Ferromanganese with more than 75 per cent. of manganese should be treated in the cold. The drying of the carbonaceous residue is often a source of decided loss.
L. DE K.

A Rapid Eggertz Process. By JOSEF SPÜLLER (*Chem. Zeit.*, 1899, **23**, 476—478).—Some practical hints as to the quickest way of applying the well-known Eggertz test for estimating carbon in iron. The details do not admit of condensation.
L. DE K.

Two Simple Methods for estimating Carbonic Anhydride in Quick Lime, Limestone, Animal Charcoal, Marls, &c., and Soils. By V. SCHENKE (*Chem. Zeit.*, 1899, **23**, 612—614).—The first method and apparatus present no novel features.

A new process is proposed for the estimation of carbonic anhydride combined with lime and magnesia in soils. The soil is ignited, finally over the blowpipe and the ash weighed; it is then moistened with ammonium carbonate and again dried over a low rose-burner; the increase in weight represents the carbonic anhydride in combination with the lime and magnesia.
L. DE K.

Estimation of Potash. By E. WIGHTMAN BELL (*Chem. News*, 1899, **79**, 135—136).—In the case of manures, 5 or 10 grams are boiled with about 150 c.c. of water, with or without addition of hydrochloric acid; ammonia is then added to slight alkalinity, and is followed by barium carbonate to the extent of about double the weight of the manure taken, the boiling being continued for half-an-hour. The mixture is filtered, the precipitate is washed, and the combined filtrate and washings made up to 500 c.c., of which 50 to 100 c.c. are evaporated to dryness, along with a small quantity of ammonium oxalate, gently ignited, treated with hot water, and filtered. The filtrate is evaporated with hydrochloric acid and platinic chloride, and the estimation completed in the usual way. With soils, either the solution in hydrochloric acid is boiled, treated with ammonia, &c., as above, or the soil is moistened with strong sulphuric acid, gently ignited, boiled with water, treated with barium carbonate, boiled again, filtered, and an aliquot portion of the filtrate evaporated with hydrochloric acid and platinic chloride, &c. The sulphuric acid treatment serves also for the estimation of potash in vegetable substances.

D. A. L.

Estimation of Alkalis in Natural Waters. By E. Bohlig (*Zeit. anal. Chem.*, 1899, **38**, 431—432).—Half a litre of the water is rapidly boiled down to 50 c.c. in a large porcelain basin, then strongly acidified with sulphuric acid, and evaporated without ebullition until fumes of sulphuric acid are given off. The residue is then washed into a 200 c.c. flask with 150 c.c. of water, some barium carbonate added, and carbonic anhydride passed through the mixture as long as any is absorbed; the insoluble matter is removed by filtration and washing, the filtrate evaporated to dryness, and the dry residue digested with 50 c.c. of a mixture of equal parts of alcohol and water. The alkali carbonates dissolve in this menstruum, whilst all other carbonates remain undissolved. After filtration, the total alkalis present can at once be estimated by titration with *N*/10 hydrochloric acid. The potassium is then precipitated as platinochloride, and the sodium calculated from the difference.

M. J. S.

Estimation of the Alkalis in Urine. By Richard Přibram and Georg Gregor (*Zeit. anal. Chem.*, 1899, **38**, 401—411).—With the object of establishing a method which, without loss of accuracy, should be sufficiently rapid and convenient for clinical purposes, the authors have examined the methods of Neubauer, Lehmann, Bunge, Salkowski-Munk and Heintz. Neubauer's method is far from satisfactory, Lehmann's process (Abstr., 1885, 609) is theoretically free from sources of error, and as it gives higher values for the potassium found than any of the other processes, it is presumed to be the most accurate. It may be improved by substituting concentrated sulphuric acid for the ammonium sulphate added before incineration of the urine residue; a white ash is then much more rapidly obtained, and there is less danger of loss of alkali. Another improvement introduced by Kretzschmar consists in evaporating to dryness, and drying at 110° after the addition of barium chloride, ammonia, and ammonium carbonate. On treating the residue with hot water containing a little ammonia, the alkali chlorides can be washed out with great facility. Both this method and Bunge's are, however, tedious. That of Salkowski-Munk is equally so, and of lower accuracy, whilst Heintz's process is confined to the estimation of the potassium, and gives seriously low results. The authors therefore propose a new process which gives results identical with those of Lehmann, but is more rapid and requires less caution on the part of the operator. 50 c.c. of urine are mixed with 10 c.c. of dilute (1 ; 10) sulphuric acid and a sufficient quantity of a 10 per cent. solution of barium permanganate (10—20 c.c.), and the mixture is boiled; after boiling for 10—15 minutes, a red coloration must still remain; this is removed by a few drops of oxalic acid. Barium chloride is then added in small excess followed by ammonia and ammonium carbonate; the precipitate is removed by filtration, and the filtrate evaporated in a platinum basin; the alkali chlorides thus obtained are usually quite free from carbonaceous matter. Should magnesium be present, as may occur in all processes in which the alkalis are weighed as chlorides, it may be eliminated by keeping the chlorides at a dull red heat in a covered platinum crucible for an hour or longer, by which means magnesium chloride is converted into oxide. It is then desirable to estimate the total chlorine by silver, and the potassium by platinum, and calculate the sodium indirectly.

M. J. S.

Separation of Zinc from Nickel. By E. Döhler (*Chem. Zeit.*, 1899, **23**, 399—400).—Zinc may be separated from nickel by precipitation with hydrogen sulphide in the presence of free acetic acid when mineral acids are absent. Good results may be obtained by using a very large excess of acetic acid, but even then the precipitated zinc sulphide may be of a dark colour and contain an admixture of nickel sulphide. It may be freed from nickel by dissolving it in dilute hydrochloric acid, which leaves most of the nickel sulphide undissolved, and after neutralising the filtrate with ammonia and adding sodium acetate and free acetic acid, again precipitating by means of hydrogen sulphide, pure white zinc sulphide being then obtained. Instead of using sodium acetate and acetic acid, the neutralised solution may be advantageously mixed with sodium formate and formic acid; the precipitate produced by hydrogen sulphide is then free from nickel, and needs no purification.

L. de K.

Electrolytic Estimations and Separations. By Lily G. Kollock (*J. Amer. Chem. Soc.*, 1899, **21**, 911—928).—Some of the older methods for electrolytic determinations and separations in potassium cyanide solutions have been repeated. The exact conditions as to current density, ampèrage and voltage and other factors have been worked out for the estimation of cadmium, silver, and mercury, and for the separation of silver, mercury, or gold from platinum, copper, zinc, nickel, or cobalt; of silver or mercury from cadmium or iron, and of gold from palladium.

Mercury may be deposited from alkali sulphide solution under the following conditions: 25 c.c. of sodium sulphide are added to a solution of mercuric chloride containing 0·1403 gram of mercury; this solution, diluted to 125 c.c., is electrolysed at 70° by a current of $N.D._{100} = 0·11$ ampère, and voltage $= 2·5$, and, at the end of 5 hours, the mercury is completely deposited. Copper can be deposited from nitric acid solution by using a current of $N.D._{100} = 0·09$ and voltage $= 1·9$ in 5 hours at 65°; mercury can also be deposited in a similar manner.

Cadmium is deposited from sulphuric acid solution in 5 hours at 65° when a current of $N.D._{100} = 0·078$ and voltage $= 2·61$ is employed. Mercury may also be estimated in a somewhat similar manner.

The conditions necessary for the accurate determination of bismuth in citric acid, ammonium citrate, or potassium citrate solution have also been determined. In the case of ammonium citrate, the solution is made ammoniacal and is electrolysed at 65°, first with a current of 0·02 ampère and 1·8 volts, the current being finally increased to

0·09 ampère and 2·3 volts. A certain amount of bismuth peroxide is always deposited on the anode and must be weighed. A current of much the same density was employed in both citric acid and potassium acetate solutions, and in the latter case the solution was made strongly alkaline by the addition of potassium hydroxide.

Iron may be deposited in the course of 7 hours from a solution containing sodium citrate and free citric acid when a current of 0·58 ampère and 5·7 volts is employed, or in 4·5 hours at 50° with a current of 0·4—1 ampère and 7—11 volts. J. J. S.

Precipitation of Cadmium by Hydrogen Sulphide. By Robert Meldrum (*Chem. News*, 1899, **79**, 170—171).—The author attributes failure to detect small quantities of cadmium, by means of hydrogen sulphide in the way usually employed, to the too liberal use of hydrochloric acid, which dissolves the sulphide. He has further investigated the precipitation by means of hydrogen sulphide of neutral solutions of cadmium sulphate varying in strength from 0·5 to 0·00125 per cent. Solutions from 0·5 to 0·25, in the cold give a curdy precipitate which settles quickly and a dense, opaque, yellow solution; when heated to boiling, the precipitate becomes orange-yellow, settles rapidly, and turns paler on cooling, but does not regain its former colour; the solution is clear with a slight yellow tinge. Agitation while cooling, and when cold, makes the precipitate settle less rapidly and renders the solution opaque. Solutions containing from 0·2 to 0·02, yield less precipitate on boiling, give little or no precipitate in an hour in the cold, and the solution remains opalescent. Solutions of greater dilution (except the 0·00125, which shows no colour in a thickness of 2 inches) yield yellow solutions, but no immediate precipitate. The filtrates from the solutions of greater strength than 0·0175 per cent. are almost free from colour in a thickness of 2 inches, but from the solutions of still greater dilution the filtrates are always coloured. By repeated filtrations, this colour may be removed from the 0·0175 to the 0·015 per cent. solutions but not from the weaker filtrates; these, however, deposit a small precipitate in 24 hours, but still retain a yellow colour.

A colorimetric method of estimating cadmium is suggested for solutions not exceeding in strength 0·02 per cent. of the sulphate.

D. A. L.

Solubility of Lead Sulphate in Aqueous Ammonium Acetate. By J. C. Long (*Amer. Chem. J.*, 1899, **22**, 217—218).—Lead sulphate is most soluble in a solution of ammonium acetate containing 33 grams per 100 c.c. To dissolve lead sulphate in analysis, it is best to add, for each gram, 10 c.c. of the ammonium acetate solution, heat to boiling, and filter promptly; to recover the lead sulphate, 0·5 gram of sulphuric acid should be added, this facilitating the evaporation and expulsion of the ammonium acetate. W. A. D.

Separation of Copper and Zinc. By W. Dederichs (*Chem. Centr.*, 1899, i, 950; from *Pharm. Zeit.*, **44**, 198).—Zinc is estimated in brass by dissolving in the smallest possible amount of nitric acid, diluting with water containing 2—3 per cent. of hydrochloric acid, and removing the copper by means of hydrogen sulphide; the filtrate is then boiled and the zinc precipitated with sodium carbonate.

To estimate copper, the nitric acid solution of the brass is digested with sodium hydrogen sulphite, and an excess of a standard solution of ammonium thiocyanate is added to precipitate the copper; the excess of the reagent is then titrated with silver nitrate in an aliquot part of the filtrate.

Traces of lead are estimated in the usual way as sulphate.

L. DE K.

Separation of Copper from Cadmium as Oxalate. By G. BORNEMANN (*Chem. Zeit.*, 1899, **23**, 565—566).—The solution of copper and cadmium, which must not be too concentrated, is mixed with a moderate quantity of nitric acid, heated to boiling, and then mixed with a slight excess of oxalic acid previously dissolved in boiling water; the liquid is then placed in a water-bath until it has become quite clear. The precipitated copper oxalate is first washed by decantation with boiling water containing a little nitric and oxalic acids, and then collected on a suitable filter and washed with boiling water containing at first a few drops of oxalic acid; in this way, the precipitate is obtained free from cadmium. The oxalate is finally converted into sulphide by ignition with sulphur in a current of hydrogen.

L. DE K.

Modification of Eschka's Mercury Assay. By K. E. CHISM (*Chem. Centr.*, 1899, i, 996; from *Trans. Amer. Inst. Min. Eng.*, Oct., 1898).—Eschka's method of mercury assay by collecting the mercury vapour on a weighed golden lid, gives accurate results, but is somewhat expensive, as the gold soon wears out. The author now substitutes a lid made of silver of about 0·02 mm. thickness; this may be used three times, and costs but little.

0·5—1 gram of the ore is mixed in a porcelain crucible with 5 grams of clean iron filings, another gram of the iron being sprinkled on the top. The crucible is placed on a perforated plate and the lid is put on, and cooled by placing on it a silver or copper basin filled with cold water. The bottom of the crucible is now heated for 15 minutes with a spirit lamp, and when cold the lid is taken off and re-weighed. On applying heat, the mercury volatilises, and the lid may be used again.

L. DE K.

Volumetric Estimation of Manganese in Manganates by means of an Alkaline Solution of Arsenious Acid. By C. REICHARD (*Chem. Zeit.*, 1899, **23**, 801—802).—The process is based on the fact that on adding an alkaline solution of arsenious acid of known strength to a solution of a manganate, the latter is reduced to manganous hydroxide. The unoxidised arsenious acid is then estimated by standard iodine; or the manganous hydroxide may be at once redissolved by adding sulphuric acid and the arsenious acid then estimated in acid solution with standard permanganate.

Five molecules of arsenious acid used for reduction are equivalent to four atoms of metallic manganese. The test experiments are satisfactory. L. DE K.

The Presence of Carbon in Electrolytically Deposited Iron. By SAMUEL AVERY and BENTON DALES (*Ber.*, 1899, **32**, 2233—2238. Compare this vol., ii, 251, and Verwer and Groll, *ibid.*, 387).—The authors maintain the accuracy of their former conclusion that the ordinary methods for the electrolytic estimation of iron do not yield satisfactory results, because a small amount of iron remains in the solution, and the deposited metal contains carbon.

In the presence of oxalic acid, the reaction with potassium thiocyanate is not delicate, and cannot therefore be depended on for indicating the completion of the deposition. Oxalic acid is converted by electrolytic reduction into glycollic acid, and the presence of this in the solution causes the deposited metal to contain carbon. A. H.

Potassium Ferrocyanide as a Source of Iron in the Volumetric Analysis of Iron. By K. SCHRÖDER (*Chem. Zeit.*, 1899, **23**, 533—534, 540—541, 557—559).—The author states that potassium ferrocyanide may be obtained almost absolutely pure and be advantageously utilised as a source of pure iron when standardising solutions for the technical estimation of iron.

Four or five grams of the pure salt are heated in a Kjeldahl flask with 20—25 c.c. of strong sulphuric acid; heat is applied, moderately at first, and then gradually increased until boiling sets in, which is then kept up for half-an-hour. When cold, 25 c.c. of water and 10—15 c.c. of hydrochloric acid of sp. gr. 1·19 are added and the mixture warmed until completely dissolved. This solution may now be reduced with zinc, or by means of stannous chloride followed by mercuric chloride, and will then be fit for standardising purposes. L. DE K.

Estimation of Iron in Organic Matter. By FRANZ RÖHMANN and FRANZ STEINITZ (*Zeit. anal. Chem.*, 1899, **38**, 433—435).—Instead of destroying the organic matter by incineration, it is far preferable to employ Neumann's method of heating with concentrated sulphuric acid and ammonium nitrate. The operation is performed in a Jena glass flask over the naked flame, the ammonium nitrate (1 gram for each c.c. of acid) being added in several portions, and the heating continued until a clear, pale yellow liquid is obtained. This is now made alkaline with ammonia and the iron precipitated as sulphide by adding a few drops of colourless ammonium sulphide with the usual precautions. The iron sulphide is collected on an ash-free filter, from which it is redissolved by sulphuric acid, the solution being run back into the precipitation flask, where it dissolves any iron sulphide adhering to the sides. Here it is concentrated by boiling and transferred to a platinum basin, in which, meanwhile, the filter has been incinerated and its ash fused with potassium hydrogen sulphate. By introducing a rod of zinc for about half-an-hour, the ferric salt is completely reduced, and is then titrated with permanganate.

In dealing with fæces, the large amount of calcium sulphate formed is an inconvenience. It is best not to attempt to remove it from the original acid solution, but to precipitate the iron sulphide in the turbid liquid. Urine (300—400 c.c.) should be mixed with 25—30 c.c. of fuming nitric acid and boiled down to a small volume before adding sulphuric acid (20—30 c.c.) and ammonium nitrate. M. J. S.

Iron Separations with Alkali Salts. I. By HARRY BREARLEY (*Chem. News*, 1899, **79**, 193—194).—It is pointed out that for the separation of iron from manganese, zinc, nickel, cobalt, and sometimes copper, alkali acetates, phosphates, sulphates, chromates, tungstates, and molybdates are amongst the available reagents. *Separation with acetates* has already been investigated (Abstr., 1896, ii, 676; 1897, ii, 388; 1898, ii, 96 and 143); it is, however, now shown that it is best not to add the acetate to the cold solution, and then to heat to boiling, but that the acetate should be added to the hot solution. Furthermore, it is shown that with a constant quantity of nickel or other metal and varying quantities of iron, the exactness does not necessarily increase with the decrease in the proportion of iron; but with fixed proportion of iron and a varying proportion of nickel, probably the separation is better for small than for large amounts of nickel.

D. A. L.

Detection of Cobalt in the Presence of Ferric Compounds. By HENDRIK WEFERS BETTINK (*Chem. Centr.*, 1899, i, 904; from *Ned. Tydschr. Pharm.*, **11**, 64—66).—When a solution of cobalt is mixed with potassium thiocyanate and a mixture of ether and alcohol poured on to the surface, a blue coloration is observed in the upper layer. In the presence of ferric salts, however, the red colour given by ferric thiocyanate interferes with the test, but in this case the iron compound may be removed by first extracting the mixture with pure ether, which dissolves the ferric thiocyanate but not the cobalt compound; the ether-alcohol mixture is then added to the residual liquid.

The author has improved the method by operating as follows: Potassium thiocyanate is added and the red coloration is destroyed by adding powdered sodium thiosulphate; the liquid is then covered with a layer of ether-alcohol. 0·001 gram of cobalt nitrate may thus be detected in the presence of 1 gram of ferric chloride.

L. DE K.

Reduction of Chromic Acid by Acetic Acid and its Effect in Anthracene Testing. By HENRY BASSETT (*Chem. News*, 1899, **79**, 157).—When the mixture of acetic acid with chromic acid used in anthracene testing is stored, the latter suffers some reduction, a reaction that is still more marked when undiluted acetic acid is boiled with chromic acid; but it also takes place with aqueous solutions of acetic acid when boiled, not, however, when the volumes of the acetic acid and water are equal. The reduction is more marked with acid crystallising at 13·5° than with the purer acid crystallising at 17°.

In anthracene testing, the less pure acetic acid and mixed solutions of acetic and chromic acids that have been kept too long (more than 15 days) will give results which are too high. D. A. L.

Testing Oil of Turpentine for Mineral Oils. By C. SCHREIBER and F. ZETZSCHE (*Chem. Zeit.*, 1899, **23**, 686—687).—The following method is suggested as a good preliminary test: 1 c.c. of the sample of turpentine is diluted to 50 c.c. with alcohol of 90—95 per cent. 20 c.c. of this solution are put into a 75 c.c. glass cylinder and 20 c.c. of a solution containing exactly 15 grams of potassium bromate and 50 grams of potassium bromide in a litre are added, followed by 20 c.c. of dilute sulphuric acid (1 : 3). The stopper is inserted and the mixture well shaken for half a minute. If the liquid should not be quite decolorised, the sample is likely to contain mineral oil and should be submitted to further analysis, but otherwise it may pass as commercially pure. L. DE K.

Estimation of Dry Substance in Glycerol. By G. BENZ (*Zeit. anal. Chem.*, 1899, **38**, 436—438).—It is commonly accepted that glycerol cannot be estimated by drying at 100°, because the glycerol begins to volatilise as soon as all the water has evaporated. The author shows, however, that this occurs only in shallow, uncovered vessels. By employing a wide-necked flask covered with a loose glass cap resting on the neck, glycerol can be dried to a constant weight either at 100° or 110°, and that this takes place without loss is shown by dissolving glycerol, so dried, in water and re-evaporating the solution in the same flask, when exactly the same weight of dry substance will be obtained. M. J. S.

Estimation of Glycerol in Fermented Liquids. By J. B. VINCENT LABORDE (*Chem. Centr.*, 1899, i, 905—906, 1086; from *Ann. chim. anal. appl.*, **4**, 76—80; 110—114. Compare Abstr., 1896, ii, 77).—The process is based on the fact, noticed by the author, that at 150—200°, glycerol is quantitatively decomposed by sulphuric acid with liberation of the whole of the carbon; 1 part of carbon represents 2·56 parts of glycerol. A quantity of liquid containing from 0·1—1·0 gram of glycerol is mixed with 10 drops of sulphuric acid and boiled down in a 250 c.c. flask with small, flat bottom until about 2 c.c. are left. 6 c.c. of sulphuric acid are then added and the flask closed with a rubber cork through which passes a glass tube drawn out to a fine point. The mixture is now heated on a sand-bath to 150°, and when the action takes place the temperature rises to 200°. After a few minutes, 5 c.c. of dilute hydrochloric acid (1 : 1) are added, and the whole is heated on the sand-bath until white fumes begin to form; the carbon is now thoroughly washed by decantation with boiling water, and then transferred to a weighed platinum dish; a little ammonia is added, and the whole dried first at 110° and then over a small rose-burner until no more ammoniacal odour is noticed. When cold, the carbon is weighed and allowance made for any ash.

To estimate glycerol in saccharine liquids, any sugar must first be removed. If the amount does not exceed 0·5 gram per litre, 50 c.c. are mixed with 100 grams of small shot, evaporated down to 2—3 c.c. and gradually mixed with 1—2 grams of calcium hydroxide; 75 c.c. of ether-alcohol mixture (2 : 1) are then added to dissolve the glycerol; the liquid is filtered, and the residue is washed with more of the ether mixture until the filtrate reaches 200 c.c. After adding 10 drops of sulphuric acid, the ether-alcohol is distilled off and the residue treated as already described.

If the amount of sugar amounts to 5—20 grams per litre, the sufficiently concentrated solution is mixed with 2 grams of calcium hydroxide which has been moistened with alcohol; if the mass does not readily set, a little more dry lime should be added; the mass must then be extracted as before with ether-alcohol mixture. If the liquid contains more than 20 grams of sugar per litre, a volume of it which will contain about 5—6 grams of sugar is mixed with 2 grams of calcium hydroxide suspended in 10—20 c.c. of proof spirit and then boiled with 100—200 c.c. of 80 per cent. alcohol. When cold, an aliquot portion of the filtrate is acidified with tartaric acid, and the alcohol having been expelled, the residue is treated as before with the ether-alcohol mixture.

The test analyses are very satisfactory. L. DE K.

Behaviour of Iron Salts with Pyrogallol. By A. HIRSCH (*Chem. Centr.*, 1899, i, 927; from *Pharm. Zeit.*, **44**, 205).—When 2 drops of a solution of ferric chloride containing 10 grams of liq. ferri. sesquichlor., in 90 of water are added to a few c.c. of a 1 per cent. solution of pyrogallol, an amethyst-blue coloration is first formed, which rapidly changes to reddish-brown, but if 1 c.c. of a 0·1 per cent. solution of sodium hydroxide or 0·5 c.c. of a 0·5 per cent. solution of sodium carbonate be then added, the solution becomes deep blue. The brown coloration is restored, however, by adding very small quantities of mineral acids. Zinc oxide or barium carbonate acts like the alkalis, hence the brown coloration must be due to the mineral acid contained in the ferric salt. Organic iron salts give blue colorations, which become brown only on addition of mineral acids. A solution of pyrogallol, rendered reddish-brown by the addition of a very dilute solution of ferric chloride, may be used to test for faint alkalinity, as, for instance, in the case of dilute solutions of alkaloids, which give the blue coloration. When pure ferrous salts are mixed with solutions of pyrogallol, a white turbidity is formed, and if a very dilute solution of sodium hydroxide is then added, the solution becomes blue, probably owing to partial oxidation of the ferrous salt.

E. W. W.

Estimation of Mannose in Mixtures of Sugars. By ÉMILE BOURQUELOT and HENRI HÉRISSEY (*Compt. rend.*, 1899, **129**, 339—341). —The solution of mannose is mixed with a solution of equal volumes of phenylhydrazine and glacial acetic acid, allowed to remain for 8 hours at the ordinary temperature, and the precipitate washed successively with ice-cold water, alcohol, and ether, and dried in a vacuum. The results are not affected by the presence of galactose, arabinose, maltose, or dextrin, and are accurate if the solution contains 3 to 6 per cent. of mannose, and the operations are conducted at as low a temperature as possible. A correction should be made by adding 40 milligrams to the weight of the precipitated hydrazone for every 100 c.c. of solution. C. H. B.

Influence of Sucrose on the Estimation of Pentosans by the Phloroglucinol Method, with special reference to Products from Sugar Refineries. By KARL ANDRLÍK (*Chem. Centr.*, 1899, i, 905; from *Zeit. Zuck. Ind. Böhm.*, **23**, 314—323).—When pentoses are estimated by the phloroglucinol method, the result, calculated as arabinose, may be from 0·60—0·89 per cent. too high if cane sugar is present.

Substances yielding furfuraldehyde are found in the diffusion syrup to the extent of only 0·2 part for every 100 parts of cane sugar; the concentrated juice contains 0·13, and the first crop of crystals 0·03 part; the greater portion of these passes into the "scum" or the molasses. L. DE K.

Cobalt Derivatives of Sucrose and of Dextrose. By W. HERZOG (*Chem. Zeit.*, 1899, **23**, 627—628).—Papasogli (Abstr., 1898, 194) states that an aqueous solution of cane-sugar, when treated with a few drops of a solution of a cobalt salt and then with an excess of sodium hydroxide, gives an amethyst-violet coloration which is moderately stable, whereas an aqueous solution of dextrose, when treated in the same manner, yields a blue colour which is remarkably evanescent, changing quickly to a dirty green, and he recommends this reaction as a test for sucrose in the presence of dextrose. The author finds that the colours produced in the two cases are very similar, that with dextrose, however, is not so stable—it immediately turns blue and then a dirty green; with saccharose, too, the final colour is dirty green. The method is therefore of no use in testing for sucrose in the presence of dextrose. With regard to the nature of the products, it is thought probable that they are compounds of the cobalt salts with alkali sucrates or dextrosates, the colour depending to a certain extent on the actual cobalt salt employed. J. J. S.

Analyses of Honey. By C. HOITSEMA (*Zeit. anal. Chem.*, 1899, **38**, 439—441).—In 10 samples of honey of known origin, the following estimations have been made: (1) specific gravity at 15° of a filtered solution of 1 part of honey in 2 parts of water; (2) pollen and wax, the constituents insoluble in warm water; (3) moisture estimated by drying without heat in a vacuum desiccator; (4) polariscopic rotation (after König, *Unters. landw. gew. wicht. Stoffe*, 1898, 474; (5) ash; (6) reducing and invertible sugars. The sp. gr. ranged from 1·102 to 1·14, water from 8·3 to 17·8 per cent.; polarisation from −3·1 to −9·1, being in all cases negative, ash, 0·12 to 0·34 per cent., pollen and wax, 0·02 to 0·46 per cent.; reducing sugar, 71·2 to 74·4; and sucrose, 0·2 to 2·6 per cent., whilst a sample of unknown origin showed 6·4 per cent. of the latter. M. J. S.

Estimation of Sugar in Fodder containing Molasses. By OTTO FOERSTER (*Chem. Zeit.*, 1899, **23**, 196).—The analysis is generally made by mixing a weighed quantity of the sample with water up to a definite volume, and afterwards making a correction for the volume of the undissolved matter; but this process can hardly lay claim to accuracy. The author recommends weighing out a multiple of 13·024 grams of the fodder and then extracting this in a Sickel's apparatus with absolute alcohol; after 12 hours, it may be taken for granted that all the sugar has been extracted. After distilling off the spirit, the residue is dissolved in water and diluted to a volume representing 75 c.c. for each 13·024 grams of the sample, and the sugar is then estimated either chemically or polarimetrically. L. DE K.

[Estimation of Caramel.] By N. FRADISS (*Chem. Centr.*, 1899, i, 1160—1161; from *Bull. de l'Assoc.*, **16**, 280).—The amount of caramel contained in sugar products is determined by treating the dry substance with a small quantity of methylic alcohol of 95°, evaporating on the water-bath, drying the gummy residue in a vacuum or in a current of dry air, and again digesting it with methylic alcohol for 2 hours. The caramel is precipitated from the solution by amylic alcohol, the precipitate redissolved, reprecipitated once or twice more, and finally dried at 90° and weighed. The caramel may also be determined by titrating with Violette's or Fehling's solution, but if dextrose is present it is necessary to titrate the original solution before and after treating with an excess of lead acetate. Then if A = c.c. of copper solution required, a = c.c. of original solution required for 5 c.c. of copper solution, the volume of the copper solution corresponding with the caramel is $5(1-a/A)$. Allowance must also be made for the amount of lead acetate solution (1/10 vol.) used. The dextrose may also be destroyed by boiling with calcium carbonate and then precipitating with carbonic anhydride. Traces of caramel are estimated by treating 200 c.c. of the solution with excess of ammoniacal lead acetate. The precipitate, after washing with water free from carbonic anhydride, is suspended in water and decomposed with hydrogen sulphide. The filtrate is again treated with lead acetate, and the solution, from which the hydrogen sulphide has been expelled by evaporating to 10 c.c., is titrated with copper solution. Determinations of the amount of caramel in various sugar products are quoted. E. W. W.

Estimation of Glycogen. By EDUARD PFLÜGER and JOSEPH NERKING (*Pflüger's Archiv*, 1899, **76**, 531—542. By EDUARD PFLÜGER, *ibid.*, 543—551. Compare this vol., ii, 529).—These two papers contain more criticisms of Külz's method, and show that it can be improved by certain modifications. A new method, which is simpler and gives practically the same results as the improved Külz method, depends on the fact that in an alkaline solution of glycogen, or extract of flesh or liver, alcohol will completely precipitate the glycogen, and if the solution contains potassium iodide, the proteid matter remains in solution. W. D. H.

Detection of "Saccharin" in Foods. By ALFRED HASTERLIK (*Chem. Zeit.*, 1899, **23**, 267—268).—The author, having tried a large number of sweetened beverages for "saccharin" by Börnstein's resorcinol test, finds that this process is absolutely worthless, as the green fluorescence is often obtained when the liquids are quite free from "saccharin," as proved by other tests. The green colour is often caused by succinic acid, traces of which are always present in fermented liquids. L. DE K.

Detection of Formaldehyde in Milk. By ALEXANDER LEYS (*J. Pharm.*, 1899, [vi], **10**, 108—114).—Gayon's solution (Abstr., 1888, 326), as used by the author for the detection of small quantities of formaldehyde in milk, is prepared by adding 10 c.c. of pure hydrochloric acid to a mixture of 10 c.c. of sodium hydrogen sulphite solution (30° B.) and 1000 c.c. of a 0·1 per cent. aqueous solution of magenta. It produces a well marked coloration with the distillate from milk containing one part of formaldehyde in a million.

H. R. LE S.

Estimation of Formaldehyde by the Aid of Hydrogen Peroxide. By OSKAR BLANK and HERMANN FINKENBEINER (*Ber.*, 1899, **32**, 2141. Compare this vol., ii, 188).—A reply to Harden's criticism (Proc., 1899, **15**, 158). The authors' contention that their method is extremely accurate has been proved by numerous determinations. J. J. S.

Iodine Number of Fatty Acids. By ALEXANDER ZEGA and R. MAJSTOROVIĆ (*Chem. Zeit.*, 1899, **23**, 597).—From experiments with fatty acids from maize oil, olive oil, sesamé oil, and cotton seed oil, the conclusion is drawn that the iodine number largely decreases when the fatty acids are kept too long in the air-bath. In the case of maize oil, it was found that the dried acids, when kept at the ordinary temperature for some days, gave a gradually decreasing iodine number, falling in 8 days from 118·6 to 102·3 per cent. L. DE K.

Modification of Kaemer's Method for the Analysis of Cream of Tartar. By G. LOMBARD (*Chem. Centr.*, 1899, i, 1086; from *Staz. sperim. agrar. ital.*, **32**, 123—126).—In Kaemer's method, a weighed quantity of the sample is dissolved in the calculated amount of normal soda, the solution diluted to 200 c.c., and 20 c.c. are acidified with acetic acid and evaporated to dryness; the residue is washed with alcohol until the washings are no longer acid, and the undissolved potassium hydrogen tartrate then estimated by means of standard alkali.

The author has successfully modified this test. 20 c.c. of the solution are mixed with 1·5 c.c. of acetic acid and then with 100 c.c. of a mixture of equal parts of commercial absolute alcohol and ether. After the lapse of 4 hours, the potassium hydrogen tartrate has separated completely, and may be freed from acid by washing with ether-alcohol mixture; it is then titrated as before. L. DE K.

Calcium Citrate and its Analysis. By ARTURO SOLDAINI and E. BERTÈ (*Gazzetta*, 1899, **29**, i, 489—497).—The authors assign the considerable differences found in the results of analyses by different workers of commercial calcium citrate to two causes. Firstly, the amount of water retained by the sample varies with the method of storage, with the time of exposure to the air, &c. Secondly, when estimated as calcium citrate, the solubility of the latter in the washing water is not properly allowed for. Error is also sometimes caused by excessive drying of the citrate which then becomes to a slight extent insoluble in acetic acid. The authors find that crystallised calcium citrate loses $2H_2O$ at 100—130°, and the remaining $2H_2O$ at 175—185°. The following method of analysis is recommended. 1 gram of the finely powdered substance is heated in an Erlenmeyer flask with 10 c.c. of water, about 20 drops of hydrochloric acid of sp. gr. 1·18 added, and when solution has taken place, the liquid is cooled, made distinctly alkaline to phenolphthalein with $N/2$ sodium hydroxide, and then about 3 c.c. of acetic acid added. The liquid is filtered and the residue washed until it is no longer acid to litmus paper, The filtrate is evaporated to dryness on the water-bath, the dry mass being taken up with 15—20 c.c. of boiling water and the solution filtered on a hot water funnel through an ashless filter of 9 cm. diameter. The residue is then washed with 55 c.c. of water in such a way as to have the last drops of the washings almost or quite colourless. The precipitate is dried, burnt, and calcined strongly for 10 minutes. T. H. P.

Estimation of Non-volatile Organic Acids in Tobacco. By Richard Kissling (*Chem. Zeit.*, 1899, **23**, 2—4. Compare Abstr., 1898, ii, 659).—I. *Separation and estimation of oxalic, citric, and malic acids by the baryta method.*—The barium salts of these acids may be obtained practically anhydrous by drying them at 70° under 100 mm. pressure; they then yield almost the theoretical amount of barium carbonate. Calcium oxalate also becomes quite anhydrous when thus treated.

The mixed acids are titrated with standard baryta, and 20 per cent. by volume of alcohol is then slowly added with constant stirring. Barium citrate and oxalate are almost completely precipitated, whilst the malate practically remains in solution, the two errors fairly compensating each other. The malate is then recovered from the filtrate by adding alcohol until its amount reaches 70 per cent. by volume, and leaving the mixture for 24 hours. Both precipitates are collected and weighed. The oxalic acid is estimated in a fresh portion of the solution of the acids by precipitation with calcium chloride in the presence of ammonium acetate.

II. *Estimation of oxalic, citric, and malic acids in tobacco.*—The process (*loc. cit.*) has been slightly modified. The first extraction of the tobacco with ether is now continued for 40—50 hours, and then again for 20 hours, this being repeated two or three times. After making up to 200 c.c., it is better to use 50 c.c. in place of 25 c.c. After shaking out the ether with 90 c.c. of water, the acids are separated as already described. L. de K.

Influence of the Quality of the Ether on the Estimation of Fat in Food-stuffs. By Theodor Methner (*Chem. Zeit.*, 1899, **23**, 37—38).—When foods contain substances readily soluble in water or alcohol, it is as well to extract the fat by means of ether which is free from either water or alcohol. Absolutely anhydrous ether may be obtained by allowing ether to stand over metallic sodium, but the author states that a very good ether may be prepared by placing the commercial article of sp. gr. 0·720 for three weeks over quicklime and then distilling. This will extract about 0·1 per cent. more than the ether prepared by means of sodium. L. de K.

Estimation of Fat in Animal Organs. By Wilhelm Knöpfelmacher (*Chem. Centr.*, 1899, i, 860—861; from *Österr. Chem. Zeit.*, **2**, 122—124. Compare Dormeyer, Abstr., 1895, ii, 540; Frank, 1898, ii, 174; Voit, *ibid.*, 175).—Fat occurs in organs in two forms, one readily extractable with ether, whilst the other seems to be mechanically combined with proteid matters and cannot be extracted by the Soxhlet apparatus in 1000 hours. According to the author, the best plan is to digest the matter with pepsin; this dissolves the proteids and so renders all the fat soluble in ether.

L. DE K.

Preservation of Hübl's Reagent. By RANDOLPH BOLLING (*Amer. Chem. J.*, 1899, **22**, 213—214).—The author's experiments show that the alteration of Hübl's reagent as regards the free iodine present is very rapid and is only slightly delayed by using absolute alcohol in preparing it or by excluding air and light. W. A. D.

Estimation of Fat in Milk. By RICHARD WINDISCH (*Landw. Versuchs-Stat.*, 1899, **52**, 209—211).—A number of samples of milk were analysed by the methods of Liebermann and Székely (Abstr., 1893, ii, 308) and Gerber. The results, which are given, indicate that both methods are satisfactory. N. H. J. M.

Aërometric Estimation of Fat in Milk. By H. TIMPE (*Chem. Zeit.*, 1899, **23**, 436—437, 455—457. Compare Abstr., 1895, ii, 95). —When milk is mixed with aqueous potash, a small but fairly definite quantity of the fat is saponified and becomes insoluble in ether; this constitutes a slight error in Soxhlet's aërometric process. Another slight source of error is the fact that the usual figures representing the mutual solubility of ether and water are not absolutely correct. Finally, the following modified formulæ are proposed: (1) $Z = A - 0{\cdot}075\ W$; (2) $F = 1{\cdot}4566\ Z\dfrac{S - 0{\cdot}7222}{(0{\cdot}9520 - S)\frac{vs}{100}}$, where A represents the weight of the ether saturated with water, W the weight of the water, Z the weight of the aqueous ether left after shaking, S the sp. gr. of the ethereal fat solution, v, the original volume of the milk, s, its sp. gr., and F, the weight of the fat it contains.

L. DE K.

Estimation of Fat in Milk. By A. A. BONNEMA (*Chem. Zeit.*, 1899, **23**, 541—542).—10 c.c. of milk are put into a 100 c.c. cylindrical glass and mixed with 1·5 c.c. of aqueous caustic potash (20 grams per 100 c.c.). After shaking for a moment, 25 c.c. of ether are added and the whole thoroughly shaken for 5 minutes, the glass being held in the warm hand. The glass is placed in cold water, the stopper removed for a moment, 2 grams of tragacanth are added, and the whole is again thoroughly shaken. The tragacanth absorbs all the water and forms a clot, whilst the ether becomes quite clear; 10 c.c. of the ethereal solution are now pipetted off and evaporated in a weighed dish. The results agree with those obtainable by the "Gerber process." L. DE K.

Varying Composition of Butter. By J. J. L. VAN RIJN (*Chem. Zeit.*, 1899, **23**, 453 - 454).—The results obtained by the author again confirm the fact that the Reichert-Meissl number for genuine butter varies from 17—32, although the majority of butters give figures varying from 23—26. The variation is due to the condition of the cows and to the quality of the food. L. DE K.

Adulteration of Butter. By Theodor Pfeiffer (*Chem. Zeit.*, 1899, **23**, 39—40).—A sample of absolutely pure butter gave, on analysis, a Reichert-Meissl number of only 19·4, and a Koetstorfer number as high as 219·4. It would therefore have been liable to be reported as adulterated with a considerable amount of margarine. It was made from the milk of three cows fed on the usual mixed diet.

L. de K.

Butter Analysis. By Alexander Zega (*Chem. Zeit.*, 1899, **23**, 312).—Butter is melted and filtered, and some of the fat is put into a test-tube and heated for 2 minutes in the boiling water-bath. One c.c. is drawn off with a small pipette previously heated and put into a glass-stoppered cylinder containing 20 c.c. of a mixture of 6 parts of ether, 4 parts of alcohol, and 1 part of glacial acetic acid. The cylinder is placed in water at 15—18°, when, if the sample is pure, the liquid remains clear or only deposits an inappreciable amount of fatty matter. With butter containing 10 per cent. or more of margarine, however, a more or less abundant deposit is obtained which may be examined microscopically. Drawings are given showing the considerable differences in appearance between the deposits from butter and from margarine. The process is also serviceable for the detection of tallow in lard; drawings of deposits from lard and tallow being also given.

L. de K.

Butter Analysis. By W. Lawrence Gadd (*Chem. News*, 1899, **80**, 113).—In the application of Reichert's test, the use of alcoholic potash that has been kept may lead to erroneous results which may be obviated by the use of solid potash in the following manner: about 2·5 grams of butter fat just at its melting point is treated in an 8 oz. flask with 20 c.c. of methylated spirit freshly distilled from caustic potash; about 1 gram of solid caustic potash is added, and the flask plunged into hot water. The saponification being complete, the alcohol is evaporated with the aid of a current of filtered air, the mass dissolved in hot water, acidified with sulphuric acid, and subjected to distillation, &c.

D. A. L.

Halphen's Test for Cotton Seed Oil. By Paul Soltsien (*Chem. Centr.*, 1899, i, 1049; from *Zeit. öffent. Chem.*, **5**, 106—107).—Halphen's test for cotton seed oil (Abstr., 1898, ii, 358) works well even without addition of amylic alcohol and sodium chloride. 10 grams of the sample of fat are mixed with 2 grams of a 1 per cent. solution of sulphur in carbon bisulphide and introduced into a test-tube which is closed with a cork through which passes a tube blown out to a bulb; the mixture is then heated for 15 minutes on a water-bath, and the colour compared with that of a known mixture of fat and cotton seed oil treated in like manner. The colour, which is very permanent, strongly resembles that of a solution of potassium dichromate.

The test is very useful, because age or rancidity of the fats do not impair it in the least, and it shows the presence of cotton seed oil, even if this has been previously heated to 200°. Lard, tallow, fats from cheese, sesamé oil, olive oil, rape oil, linseed oil, poppy oil, arachis oil, hazelnut oil, and cod-liver oil are not affected.

L. de K.

Presence of Chlorinated Organic Compounds and Absence of Sulphur Compounds in Cotton Seed Oil. By P. N. Raikow (*Chem. Zeit.*, 1899, **23**, 769—770 and 802).—Although cotton seed oil does not contain sulphur, it gives the phloroglucinol-vanillin test (this vol., ii, 52); this is due to the presence of chlorinated compounds, which, on burning, yield hydrogen chloride. By means of the tubular lamp previously described, the oil was burnt in a beaker placed on its side and the inner surface of the beaker was kept moistened with potassium hydroxide solution. Dupont's method (Abstr., 1896, i, 409) has also been employed, but no sulphur could be detected. The chlorinated compound is not extracted by water, but is somewhat volatile in superheated steam.

Olive oil and walnut oil, although they give the phloroglucinol reaction, are free from both sulphur and chlorine (compare Fox and Riddick, *Chem. News*, 1895, **71**, 296; also Dupont and Charabot, *Bull. Soc. Chim.*, 1896, [iii], **15**, 341). The presence of chloro-derivatives in cotton seed oil may be made use of in determining whether this oil has been employed in adulterating other oils. J. J. S.

"Vegetale" (Cotton-Stearin): Isolation of Cholesterol and Phytosterol from Fats. By F. Wirthle (*Chem. Zeit.*, 1899, **23**, 250).—"Vegetale" consists of crude cotton-stearin, and occurs as a yellow, semi-solid mass which, after being melted, does not readily solidify. Its iodine number is 89·24, and its saponification number 196·1. It gives the Bechi test in a very marked degree, and shows a refraction of 63·3° at 25°. By using Böhmer's process for the isolation of cholesterol and phytosterol, the latter may be readily detected, and mixed crystals of both these substances may be obtained from lard adulterated with only 10 per cent. of "vegetale." Böhmer's process gives satisfactory results even with very rancid fats, and it is only when the samples have been kept for many years under unfavourable conditions that no crystals can be obtained. Kreis's process for the isolation of cholesterol and phytosterol (this vol., ii, 343) requires 50 grams of fat, whilst Böhmer's test may be made with 25 grams only, so it possesses no decided advantages. L. de K.

Isolation of Cholesterol and Phytosterol from Fats. By Otto Foerster (*Chem. Zeit.*, 1899, **23**, 188).—The author objects to the process recommended by Kreis and Wolf (this vol., ii, 343), as in the case of a sample of oil of mustard it only gave 0·03 gram of phytosterol, whilst in another experiment, conducted by the author's process (this vol., ii, 121), 0·6 gram was obtained. L. de K.

New Reactions of Sesamé Oil. By Ferdinand Breinl (*Chem. Zeit.*, 1899, **23**, 647).—The author states that, in place of testing for sesamé oil with hydrochloric acid and a 2 per cent. alcoholic solution of furfuraldehyde, a 3 per cent. alcoholic solution of hydroxybenzaldehyde, vanillin, or piperonal may, with advantage, be substituted.
L. de K.

Bishop's Test for Sesamé Oil. By Hans Kreis (*Chem. Zeit.*, 1899, **23**, 802—803).—Stale sesamé oil, when shaken with an equal volume of hydrochloric acid of sp. gr. 1·19, turns green, and if sugar is also added, a blue colour is developed.

A remarkable result was obtained by the author: a very rancid olive oil gave no colour with hydrochloric acid, but on adding some fresh sesamé oil, which also gave no test with hydrochloric acid, the green colour was at once apparent. Further results are promised.

L. DE K.

Analysis of Human Urine. By WILLIAM CAMERER and FRIEDRICH SÖLDNER (*Zeit. Biol.*, 1899, **38**, 227—290).—The principal methods of urine analysis are criticised and experimentally compared. The most important outcome appears to be that, in the estimation of urea by the Mörner-Sjöquist method, part of the nitrogen of hippuric acid, allantoin, and creatinine is reckoned as urea nitrogen. The methods of estimating uric acid, alloxuric bases, ammonia, and other substances are also examined. W. D. H.

[Estimation of Allylthiocarbimide in] Seeds of some Varieties of Brassica and Sinapis. By WILHELM KINZEL (*Landw. Versuchs-Stat.*, 1899, **52**, 169—193).—The method employed was that of Dirck as modified by Schlicht (Abstr., 1892, 1035), except that the substance was steam-distilled, as proposed by Förster (*Landw. Versuchs-Stat.*, 1898, **50**, 419). Powdered rape cake (15 grams) and white mustard (4 grams) are mixed with water (150 c.c.) and tartaric acid (0·25 gram) in a 500 c.c. Erlenmeyer flask. The heating of the steam flask is so arranged that steam begins to pass over in about half-an-hour; the Erlenmeyer flask is now heated with a small flame until, in 1½ hours, 200 c.c. has distilled over. The vapours pass through a 0·6 cm. tube, 70 cm. long, into three receivers (an Erlenmeyer flask, a Will-Varrentrapp apparatus, and a second Erlenmeyer flask) containing 100, 18, and 10 c.c. respectively of alkaline permanganate solution. As the distillation proceeds, the heating of both flasks must be increased to avoid violent rising of the liquid in the Will-Varrentrapp apparatus. The safety tube of the steam flask is only opened in the case of the permanganate flowing backwards to the flask containing the substance. The liquid in the three receivers is mixed, heated for an hour on a water-bath, and after cooling to 70°, treated with alcohol (25 c.c.) and diluted to 501 c.c. Every 3·333 grams of precipitate ($KH_3Mn_4O_{10}$) corresponds with 1·012 c.c. of solution at 17·5°. After filtration and addition of a little acid and iodine, the sulphuric acid is determined in the manner described by Schlicht (*loc. cit.*), the result being corrected by adding 0·00319 to the amount of barium sulphate from 400 c.c.

The results obtained with a number of samples of different varieties of brassica from India are given. N. H. J. M.

Estimation of Urea. By SERGEI SALASKIN and J. ZALESKI (*Zeit. physiol. Chem.*, 1899, **28**, 73—87).—The estimation of urea in urine by the Mörner-Sjöquist method gives results which are too high. This is because part of the hippuric acid nitrogen is reckoned as urea nitrogen; and the more hippuric acid the urine contains the greater the error. The method suggested is to heat the residue after the ether and alcohol are evaporated off, in a glass tube, and to estimate the urea from the ammonia thus given off. W. D. H.

Volumetric Estimation of Aniline and Bromine. By GEORGES DENIGÈS (*J. Pharm.*, 1899, [vi], 10, 63—66).—A claim for priority with respect to the method proposed by François (this vol., ii, 713) for the estimation of aniline. H. R. LE S.

Methods of Estimating Alkaloids. By OTTO LINDE (*Arch. Pharm.*, 1899, **237**, 392—408. Compare this vol., ii, 534).—Keller's method (compare Abstr., 1897, ii, 84) is open to the following objections. (1.) The assumption is made that the solvent either extracts all the alkaloid, or, at least, contains it in equal concentration throughout, whether within or without the drug; it is found, however, that the residual part, including the much-swollen drug, contains proportionally more alkaloid. (2.) The amount of solution removed is assumed to contain 100/120 of the alkaloid; as a matter of fact, the total amount of the solution may have suffered an increase owing to the solution in it of fat, and even of soap. (3.) The repeated shaking and the large amount of solvent used are objectionable; shaking once with a smaller quantity suffices if the volume of the aqueous solution is kept relatively small; it may also be saturated with some salt. (4.) It is better to measure the quantities of solvent used than to weigh them; pipettes graduated for use with water may be employed.

Ekroos' method (this vol., ii, 74) cannot be used with drugs from which ammonia or an aliphatic amine is liberated by treatment with soda; neither can it be used with drugs which contain oil, as in these cases a soap is formed which dissolves in the chloroform-ether, and uses up some of the sulphuric acid.

Katz's method (Abstr., 1898, ii, 547) is equally unavailable for drugs from which soda liberates ammonia or an amine.

It is better not to estimate an alkaloid only by titrating its solution, but first to weigh it after evaporation of the solution, in which process volatile alkalis are removed, and then to titrate the residue; a serious discrepancy between the two results would indicate adulteration. C. F. B.

Hydrastine Pentiodide Hydriodide. Volumetric Estimation of Hydrastine and Berberine in the Root of Hydrastis Canadiensis. By HARRY MANN GORDIN and ALBERT B. PRESCOTT (*Arch. Pharm.*, 1899, **237**, 439—446).—When a dilute solution of hydrastine is added to a large excess of a solution of iodine in aqueous potassium iodide, a dark brown compound, $C_{21}H_{21}O_6N,HI,I_5$, is precipitated; this melts readily under water; it loses 5I when treated with sulphurous acid or sodium thiosulphate.

For the estimation of the alkaloids in *Hydrastis canadiensis*, 10 grams of the powdered root are stirred into a paste with a mixture of alcohol, concentrated ammonia, and ether (1 : 1 : 6 parts by volume), and allowed to remain in a well-closed vessel for several hours. The mixture is then dried, at first in a good draught and then over sulphuric acid under diminished pressure; the residue is transferred to a Soxhlet apparatus, being rinsed out with powdered barium nitrate, and the hydrastine is extracted completely with absolute ether; the ether is evaporated from the extract, and the residue dissolved in acidified water, and the solution diluted to 100 c.c. In a graduated 100 c.c. flask, 20—30 c.c. of a standard iodine solution (of about 1 per cent. strength) are placed, 20 c.c. of the filtered hydrastine solution run in, and the mixture diluted to the mark and shaken until the pentiodide has all separated; the mixture is then filtered, and the excess of iodine determined by titrating 50 c.c. of the filtrate with standard sodium thiosulphate solution. Every 1 part of iodine used corresponds with 0·60403 part of hydrastine. Or the alkaloid may be estimated gravimetrically by shaking 20 c.c. of the filtered hydrastine solution with benzene and ammonia, removing the alkaloid from the benzene solution by shaking with acidified water, and then from the acid solution with ammonia and ether, the ethereal solution is finally evaporated in a dark place at the ordinary temperature, and the residue of hydrastine weighed.

The residue in the Soxhlet apparatus contains the berberine, which is not soluble in absolute ether; it is dried by passing a current of dry air through the apparatus, and is then extracted with alcohol. The alcohol is removed from the extract by heating it with 200 c.c. of water on the water-bath; the residual liquid is acidified with acetic acid, cooled, and filtered into a conical flask; in this it is shaken for 10—15 minutes with 6—8 c.c. of acetone and enough 10 per cent. caustic soda solution to render the reaction alkaline, and set aside for 2—3 hours. The precipitated acetone compound is washed, and warmed in the same flask with 200—300 c.c. of very dilute sulphuric acid until it has all dissolved, the solution is poured into a long-necked Kjeldahl flask and boiled for 1½—2 hours; when cold, it is added to 100 c.c. of *N*/20 potassium iodide solution contained in a graduated 1000 c.c. flask, diluted to the mark, shaken, and left overnight. Then 500 c.c. are filtered from the precipitate of berberine hydriodide into another 1000 c.c. flask, treated with 50 c.c. *N*/20 silver nitrate and nitric acid, diluted to the mark, and filtered; the excess of silver is determined by titrating 500 c.c. of the filtrate with *N*/40 ammonium thiocyanate. The number of c.c. of the iodide solution used, multiplied by 0·167125, gives the percentage of berberine in the root. C. F. B.

Vitali's Test for Veratrine. By IWAN L. KONDAKOFF (*Chem. Zeit.*, 1899, **23**, 4).—The author confirms Kunz-Krause's statement that when veratrine is evaporated with fuming nitric acid and the residue treated with alcoholic potash, the mixture turns blood-red and evolves a strong odour of coniine. The odorous substance is really coniine, and not β-picoline. L. DE K.

Melzer's Picrotoxin Reaction. By HANS KREIS (*Chem. Zeit.*, 1899, **23**, 21—22).—The author warns toxicologists that cholesterol and phytosterol also give reactions with benzaldehyde and sulphuric acid very similar to that described as characteristic for picrotoxin by Melzer (Abstr., 1898, ii, 650). L. DE K.

Estimation of Proteids in Blood Serum. By GUSTAVE PATEIN (*J. Pharm.*, 1899, [vi], **10**, 244—249).—*Alkaliseralbumin* is the name given by the author to the albumin precipitated by acidifying diluted human blood serum with 10 per cent. acetic acid. For its estimation, 100 c.c. of the serum are diluted with 900 c.c. of water, and the liquid is rendered faintly acid with 10 per cent. acetic acid. The mixture is left for 24 hours, and the precipitate washed by decantation with water slightly acidified with acetic acid. It is then dissolved in 60 c.c. of water previously acidified with acetic acid, 1 to 2 grams of sodium sulphate or chloride are added, and the solution boiled. From this stage, the process is the same as for the estimation of albumin.

Estimation of total albumin.—10 c.c. of the serum are diluted to 100 c.c. with water, the liquid is rendered very faintly acid with acetic acid, and 2 grams of sodium sulphate are added. The mixture is boiled, and the precipitate, collected on a tared filter, washed with boiling water, alcohol, and ether, and dried and weighed.

Estimation of serin and serum-globulin.—The serum previously diluted with 9 times its volume of water, is rendered faintly acid with acetic acid and the mixture left for 24 hours. It is then heated to boiling, and the precipitate collected, dried, and weighed.

Estimation of serin.—The serum is diluted with 9 times its volume of water, and 100 c.c. of this solution are saturated with magnesium sulphate. The liquid is filtered, and an aliquot part of the filtrate, faintly acidified with acetic acid, is boiled, and the precipitated serin dried and weighed. The serum-globulin is estimated by difference. 1000 grams of blood serum were found to contain: total proteids, 75·4; alkaliseralbumin, 2·45; serin and other proteids, 45·03; and globulin, 27·92. H. R. Le S.

Estimation of Albumin in Urine. By Georges Denigès (*J. Pharm.*, 1899, [vi], 10, 97—102).—The author's method for the estimation of casein in milk (Abstr., 1897, ii, 532) is applicable to the estimation of albumin in urine. For urine containing not more than 1·1 grams of albumin per litre, the method is as follows: 20 c.c. of mercuric potassium iodide and 2 c.c. of glacial acetic acid are added to 150 c.c. of the urine, and the whole diluted to 200 c.c. The mixture is filtered, and 25 c.c. of an ammoniacal solution of potassium cyanide (equivalent to $N/20$ silver nitrate) are added to 125 c.c. of the filtrate, the whole left for 2 or 3 minutes, and again filtered. To 120 c.c. of the last filtrate, $N/10$ silver nitrate is added until a faint, but permanent, opalescence is produced. The number of tenths of a c.c. of silver nitrate less 48 (a constant) gives the number of decigrams of albumin in a litre of urine.

If the urine contains more than 1·1 grams of albumin in a litre, then the number of c.c. of urine used must be such that it shall not contain more than 0·15—0·16 gram of albumin, and shall be a simple ratio of 150. If the urine contains less than 0·2 gram of albumin in a litre, the amount is determined by comparing the opalescence produced by the addition of 2 c.c. of a 5 per cent. solution of sodium metaphosphate and 4 drops of sulphuric acid to 10 c.c. of the urine and heating in boiling water for 5 minutes, with that produced, under the same conditions, with urine solutions containing a known weight of albumin.

H. R. Le S.

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Acethydroxamic acid.
Acetic acid.
Acetoacetic acid.
Acetobutyric acid.
Acetohydroxybenzoic acid.
Acetonedicarboxylic acid.
Acetoneoxalic acid.
Acetonetricarboxylic acid.
Acetophenylhydrazidoformic acid.
γ-Acetoxydiethylacetoacetic acid.
Acetoxydimethylacetoacetic acid.
Acetoxy-$\alpha\alpha_1$-dimethylglutaconic acid.
β-Acetoxy-$\alpha\alpha_1$-dimethylglutaric acid.
β-Acetoxyethanesulphonic acid.
Acetoxyethylsulphonic acid (*acetyl*is*ethionic acid*).
Acetoxyhydroxydimethylglutaric acid.
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- Acetyldimethylheptoic acid.
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- Acetylethoxyphenylmalamic acid.
- Acetyllactic acid.
- Acetylmalic acid.
- Acetylmethyl*cyclo*pentenedicarboxylic acid.
- Acetylpropionic acids.
- Acetyl*iso*propylpropanetricarboxylic acid.
- Acetylsalicylic acid.
- Acetylsuccinic acid.
- Acetyltartaric acid.
- Acetyltrimethylenetricarboxylic acid.
- Aconic acid.
- Aconitic acid.
- Acrylacetic acid (*tetric acid*).
- Adipic acid.
- Alanine.
- β-Aldehydo*iso*butyric acid.
- Aldehydophenoxyacetic acid.
- β-Aldehydopropionic acid.
- *o*-Aldoximephenoxyacetic acid.
- Aleuritic acid.
- Allylacetic acid (*pentenoic acid*).
- Allylparabanic acid.
- Allylthioparabanic acid.
- *iso*-Amylacetic acid (*heptoic acid*).
- *iso*-Amylacetoacetic acid.
- α-*iso*-Amylcrotonic acid.
- *iso*-Amylidenebismalonic acid.
- *iso*-Amylmalonic acid.
- *iso*-Amylphosphinic acid.
- *iso*-Amylphosphinous acid.
- *iso*-Amylsuccinic acid.
- *iso*-Amylthiophosphinic acid.
- *iso*-Amylxanthic acid.
- Anemonolic acid.
- Anhydracetonebenzil-β-carboxylic acid.
- α-Anhydrobenzillævulic acid.
- Anhydrocamphoronic acid.
- Anhydrohomocamphoronic acid.
- Anilinedisulphonic acid.
- Anilinoacetic acid.
- Anilinobenzoic acid.
- Anilinobenzylacetoacetic acid.
- β-Anilino-α-carboxyglutaric acid.
- γ-Anilinodimethylacetoacetic acid.
- Anisic acid.
- Anisoilsulphinic acid.
- Anisoilsulphonic acid.
- Anisyl*di*thiocarbazinic acid.
- Anisylidenediacetoacetic acid.
- Anisylidenemalonic acid.
- Anthranilic acid.
- Antimonylgallic acid.

Acids. See :—

- Arabic acid.
- Arabonic acid.
- Arachidic acid.
- Asparagine.
- Aspartic acid.
- Atranoric acid.
- Azaurolic acid.
- Azelaic acid.
- Azinocarbonic acid.
- Azobenzenecarboxylic acid.
- Barbatic acid.
- Barbituric acid.
- Beetroot-resin acid.
- Benzamidobenzoic acid.
- Benzeneazoacetoacetic acid.
- Benzenesulphinic acid.
- Benzenesulphonic acid.
- Benzhydroxamic acid.
- Benzil-*o*-carboxylic acid.
- Benzilic acid.
- Benzimidazoledicarboxylic acid.
- Benzimidoxydiphenylacetic acid.
- Benzoic acid.
- Benzophosphinic acid.
- Benzoxyhydroxydimethylglutaric acid.
- Benzoylacetic acid.
- Benzoylacetoacetic acid.
- Benzoylacrylic acid.
- Benzoylalanine.
- Benzoylaspartic acid.
- Benzoylbenzhydroxamic acid.
- Benzoylbenzoic acid.
- Benzoyldimethylcrotonic acid.
- Benzoylethylthiocarbamic acid.
- Benzoylglutamic acid.
- Benzoylmalic acid.
- β-Benzoylpropionic acid.
- Benzoyltartaric acid.
- Benzoylthiocarbonic acid.
- Benzoyltrimethylenetricarboxylic acid
- Benzylbenzylidenepyrotartaric acid.
- Benzylcyanacetic acid.
- Benzylformhydroxamic acid.
- Benzylglutaconic acid.
- Benzylideneanhydracetonebenzil-α-carboxylic acid.
- Benzylidene-α-anhydrobenzillævulic acid.
- Benzylideneanilinoacetoacetic acid.
- Benzylidene-bisacetoacetic acid.
- Benzylidenecornicularic acid.
- Benzylidenediacetoacetic acid.
- Benzylidene-α-glucoheptonic acid.
- Benzylidenehydrazinesulphonic acid.
- Benzylidenemalonic acid.
- Benzylidenephenacylcinnamic acid.
- Benzylidene-*d*-saccharic acid.
- Benzylmalonic acid.
- Benzylmethylketone-*o*-carboxylic acid.
- Benzyloxybenzenesulphonic acid.
- Benzylparaconic acid.

Acids. See :—
Benzylphthalaminic acid.
Benzylpyruvic acid.
Benzylsuccinic acid.
Bilianic acid.
iso-Bilianic acid.
Biliverdic acid.
Bisacetoaceticazodiphenyldicarboxylic acid.
Bisacetonediphenyldihydrazonedicarboxylic acid.
Bisdiazoiminodiphenyldicarboxylic acid.
Bismesoxalicdihydrazonediphenyldicarboxylic acid.
Bisphenolazodiphenyldicarboxylic acid.
Boheic acid.
l-Bornylic acid.
Boswellic acid.
Brassidic acid.
Brucinic acid.
cyclo-Butanecarboxylic acid.
Butanedicarboxylic acid.
cyclo-Butanedicarboxylic acid.
Butanetetracarboxylic acid.
Butoxysuccinic acids.
iso-Butylacetic acid (*hexoic acid*).
iso-Butyl*iso*aconic acid.
iso-Butylaticonic acid.
Butylbenzoic acid.
iso-Butylcitraconic acid.
Butylenedicarboxylic acid.
iso-Butylethanetricarboxylic acid.
β-*iso*-Butylglutaric acid.
iso-Butylideneacetoacetic acid.
iso-Butylidenebismalonic acid.
Butylmalonic acid.
iso-Butylmesaconic acid.
iso-Butylparaconic acids.
Butylphenylglyoxylic acid.
iso-Butylphosphinic acid.
iso-Butylphosphinous acid.
iso-Butylpyruvic acid.
iso-Butylsuccinic acid.
iso-Butylxanthic acid.
n- and *iso*-Butyric acids.
Butyrylmalic acid.
iso-Butyrylmalic acid.
iso-Butyrylmalonic acid.
allo-Caffuric acid.
Camphanic acids.
Camphoceenic acid.
Camphoceonic acid.
Camphoic acid.
Camphononic acid.
Camphorenic acid.
Camphoric acid.
iso-Camphoronic acid.
Camphosulphonic acid.
Cannabinolactonic acid.
Cantharic acid.

Acids. See :—
iso-Cantharidic acid.
Caperatic acid.
Capric acid (*decoic acid*).
Caproic acid (*hexoic acid*).
Caprylic acid (*octoic acid*).
Carbonamidohydrazopropionic acid.
Carbonylphenylcarbazinic acid.
iso-Carbopyrotritaric acid.
α-Carboxy-α′-acetyladipic acid.
Carboxybenzenesulphinic acid.
Carboxy*apo*camphoric acid.
Carboxyglutaric acid.
Carboxymethylfurfuranacetic acid.
Carboxyoxalacetic acid.
o-Carboxyphenylacetic acid.
Carboxyphenyl-diphenylpyrazoline.
Carboxyphenylethylpropionic acid.
Carboxyphenylmethylpropionic acid.
Carboxyphenyl-phenyl*iso*oxazoline.
Caronic acid.
Catechoylcarboxylic acid.
Cerotic acid.
Cetraric acid.
Cholic acid.
Chrysammic acid.
Chrysatropic acid.
Cilianic acid.
Cincheninesulphonic acid (*cinchinesulphonic acid*).
Cineolenic acid.
Cineolic acid.
Cinnamaldehyde, sulphonic acids of.
Cinnamenylsuccinic acid.
Cinnamic acid.
Cinnamylformic acid.
Cinnamylidenedimethylcrotonolactonecarboxylic acid.
Cinnamylidenemalonic acid.
Citraconic acid.
Citral, hydrosulphonic acids of.
Citralidenecyanacetic acid.
Citramalic acid (*methylmalic acid*).
Citrapyrotartaric acid (*methylsuccinic acid*).
Citrazinic acid.
Citric acid.
Citronellal, hydrosulphonic acids of.
Citronellic acid.
Citronellylidenecyanacetic acid.
Citrylidenemalonic acid.
Citryl-β-naphthacinchonic acids.
Coccellic acid.
Cornicularic acid.
Coumaric acid.
Coumarincarboxylic acid.
Crotonic acid.
Cumenesulphinic acid.
Cumenylanilinoacetic acid.
Cuminylidenediacetoacetic acid.
Cumylidenemalonic acid.
Cyanuric acid.

Acids. See :—
iso-Cymenesulphonic acid.
Cymylcarboxylic acid.
Cymylglyoxylic acid.
Decoic acid.
Dehydrocamphenylic acid.
Dehydromucic acid.
Deoxybenzoindicarboxylic acid.
Dextrinic acid.
Diacetamidodiphenyldicarboxylic acid.
Diacetoacetic acid.
Diacetophenylcrotonic acid.
αα-Diacetyladipic acid.
Diacetylglyceric acid.
Diacetylmethyl*cyclo*pentenecarboxylic acid.
Diacetylsuccinic acid.
Diacetyltartaric acid.
Di*iso*amylacetic acid (*dodecoic acid*).
Di*iso*amylmalonic acid.
Dianisylacetic acid.
Dianisyldihydrazonecyanoacetic acid.
Dianisyldihydrazonemalonic acid.
Diazoacetic acid.
Diazobenzenesulphonic acid.
Diazotriazolecarboxylic acid.
Dibenzamidodiphenyldicarboxylic acid.
ββ-Dibenzoyl*iso*butyric acid (*diphenacylacetic acid*).
ββ-Dibenzoylcyano*iso*butyric acid (*diphenacylcyanacetic acid*).
Dibenzoylglutaric acid.
Dibenzoylglyceric acid.
Dibenzoylmesitylenic acid.
Dibenzoylsuccinic acid.
Dibenzoyltartaric acid.
Dibenzoyltrimesic acid.
Dibenzoyluvitic acids.
Dibenzylcyanoacetic acid.
Dibenzylidene-*l*-idonic acid.
Dibenzylidenepropionic acid.
Dibenzylidene-*l*-xylonic acid.
Dibutyryltartaric acids.
Dicampherylic acid.
Dicarbintetracarboxylic acid (*ethylenetetracarboxylic acid*).
Dicarboxyglutaconic acid.
αα-Dicarboxymethoxycarballylic acid.
Dicarboxyphenylic bisulphide.
o-Diethoxydiphenyltetrahydropyronedicarboxylic acid.
Diethoxysuccinic acid.
Diethylacetoacetic acid.
Diethylallylmalonic acid.
Diethylaminobenzoylbenzoic acid.
Diethylaminocinnamic acid.
Diethylaminomaleic acid.
Diethylanilinethionamic acid.
Diethylcyanoacetic acid.
Diethylindoleninecarboxylic acids.
β-Diethyllactic acid.

Acids. See :—
β-Diethylmalic acid.
Diethylphosphinic acid.
Diethyl*di*thiocarbamic acid.
Digallic acid.
Digitalonic acid.
Digitic acid.
Digitogenic acids.
Digitoic acid.
Digitoxic acid.
Digitoxosecarboxylic acid.
Diglutaric acid.
Diglycolamic acid.
Dihexoyltartaric acid.
Dihydro*cis*campholytic acid.
Dihydrocamphoric acid.
Dihydro*iso*lauronic acid.
Dihydro-ψ-lauronolic acid.
Dihydroterephthalic acid.
Dihydrouvitic acid.
Dihydroxybehenic acids.
Dihydroxybutyric acid.
Dihydroxycamphoceenic acid.
Dihydroxycinnamic acid.
α′β-Dihydroxy-αα-diethylglutaric acid.
Dihydroxydimethylacetoacetic acid.
α′β-Dihydroxy-αα-dimethylglutaric acid.
Dihydroxydioxy-ββ′-dipyridyldicarboxylic acid.
Dihydroxydiphenyldicarboxylic acid.
Dihydroxyhexoic acid (*propylglyceric acid*).
Dihydroxymaleic acid.
Dihydroxymethyl*iso*butylideneacetic acid.
βγ-Dihydroxy-αα-methylethylglutaric acid.
Dihydroxynicotinic acid.
Dihydroxynonoic acid.
Dihydroxyphenylacetic acid.
Dihydroxyphenylpyridinecarboxylic acid.
αβ-Dihydroxypropionic acid (*glyceric acid*).
Dihydroxystearic acids.
Dihydroxysuccinic acid.
Dihydroxyvaleric acid (*α-ethylglyceric acid*).
Di-isatic acid.
Diketobutyric acid.
4 : 7-Diketoheptanecarboxylic acid.
Diketophenoheptamethylenedicarboxylic acid.
Dimalodiaspartic acid.
Dimalohexaspartic acid.
Dimercuracetic acid.
Dimethoxyphenylglyoxylic acid.
Dimethoxysuccinic acid.
Dimethylacetoacetic acid.
Dimethylacetylsuccinic acids.

Acids. See :—
Dimethylacrylic acid (*pentenoic acid*).
Dimethylallylmalonic acid.
Dimethylaminobenzoylbenzoic acid.
Dimethylaminobenzylbenzoic acid.
Dimethyl-*o*-aminophenolsulphonic acid.
Dimethylaminothiobenzoic acid.
Dimethylanilinesulphonic acids.
Dimethylaniline-*p*-thionamic acid.
Dimethylanilinophthaloylic acid.
Dimethylaticonic acid.
Dimethylbenzimidazolonecarboxylic acid.
Dimethylbutanetricarboxylic acid.
Dimethylbutyric acid (*hexoic acid*).
Dimethylcitraconic acid.
αα-Dimethyl-*αα*-dicarboxymethoxytricarballylic acid.
Dimethyldihydroresorcylic acid.
Dimethyleneasparagine.
Dimethylethylbenzoic acid.
Dimethylfumaric acid (*β-methylmesaconic acid*).
iso-Dimethylfurfurandicarboxylic acid (iso*carbopyrotritaric acid*).
Dimethylglutaconic acid.
αα-Dimethylglutaramic acid
ββ-Dimethylglutaranilic acid.
Dimethylglutaric acids.
Dimethylgranatenic acid.
Dimethylheptanonoic acid.
Dimethyl*cyclo*hexanecarboxylic acid.
Dimethylhexanonoic acid.
Dimethyl*cyclo*hexenecarboxylic acid.
Dimethylhydrofurfurancarboxylic acid.
Dimethylhydroresorcylic acid.
Dimethylitaconic acid.
Dimethyllævulic acid.
Dimethylmaleic acid (*pyrocinchonic acid*).
Dimethylmesaconic acid.
3-Dimethyl-4-methylpentane-2 : 5-olidoic acid.
Dimethyl-*α*-naphthoic acid.
Dimethyl*iso*paraconic acid (iso*terebic acid*).
Dimethyl*cyclo*pentanedionedicarboxylic acid.
Dimethyl*cyclo*pentanonecarboxylic acid.
Dimethylphthalic acid.
Dimethyl*cyclo*propanedicarboxylic acid.
ββ-Dimethylpropanetetracarboxylic acid.
ββ-Dimethylpropanetricarboxylic acid.
Dimethylpropionic acid (*valeric acid*).
Dimethylpyrimidinecarboxylic acid.
Dimethylsuccinic acids.
Dimethyltartaric acid.

Acids. See :—
Dimethylterephthalamic acid.
Dimethylterephthalic acid.
Dioxysuccinic acid.
3 : 9-Dimethyluric acid.
Diphenacylacetic acid.
Diphenacylcyanoacetic acid.
Diphenetylacetic acid.
Diphenylacetic acid.
Diphenylaminecarboxylic acid.
Diphenylbuteninecarboxylic acid.
Diphenylbutyrolactoneacetic acid.
Diphenylcarbamic acid.
Diphenylcarbamidedicarboxylic acid.
Diphenylcarboxylic acid.
Diphenylcrotonolactoneacetic acid.
Diphenylcrotonolactonecarboxylic acid.
Diphenyldicarboxylic acids.
Diphenyldihydrazinedicarboxylic acid.
Diphenyldihydrazonecyanoacetic acid.
Diphenyldihydrazonemalonic acid.
Diphenyldihydrodicarbolutidinic acid.
Diphenyldimethylpyrazolineacetic acid.
Diphenylglyoxylic acid.
Diphenylhexatrienecarboxylic acid.
Diphenylitaconic acid.
Diphenylparaconic acid.
Diphenylpentenoic acid.
Diphenylpyronecarboxylic acid.
Diphenylpyrotartaric acid.
Diphenylthioallophanic acid.
Diphenylthiomaleuric acid.
Diphenyltolylmethanecarboxylic acid.
Diphthalylic acid.
Dipiperidoquinonedicarboxylic acid.
Dipropionyltartaric acid.
Di*iso*propoxysuccinic acid.
Dipropylarsinic acid.
s-Di*iso*propylsuccinic acids.
Di*iso*propylbutenedicarboxylic acid.
Dipyridyltetracarboxylic acid.
Disalicyl-*o*-toluic acid.
Di-*p*-toluidido-oxalic acid.
Ditoluoylglyceric acids.
Ditoluoyltartaric acid.
Ditolylacetic acid.
Ditolyldicarboxylic acid.
Ditolyldihydrazonecyanoacetic acid.
Ditolylphenylmethane-*o*-carboxylic acid.
Divaleric acid (*decoic acid*).
Divaleryltartaric acids.
Dixgenic acid.
Dodecoic acids.
Durenecarboxylic acids.
Ecgonine methiodide.
Elaidic acid.
Erucic acid.
Ethaconic acid.

Acids. See :—
  Ethanedicarboxylic acid (iso*succinic acid*).
  Ethanesulphonic acid.
  Ethanetetracarboxylic acid.
  Ethoxybenzenesulphonic acid.
  Ethoxybenzoic acid.
  Ethoxydiphenylcarboxylic acid.
  2-Ethoxyhexahydro-*o*-toluic acid.
  Ethoxymethylbenzoic acid.
  Ethoxymethylenecyanoacetic acid.
  Ethoxymethyl*cyclo*hexanecarboxylic acid.
  Ethoxymethylpropylbenzoic acid.
  Ethoxynaphthylglyoxylic acid.
  Ethoxyphenylhydantoic acid.
  Ethoxyphenylmalamic acid.
  Ethoxypropionic acid.
  Ethoxysuccinic acid.
  Ethoxy-xylic acid.
  Ethylacetoacetic acid.
  Ethylacrylic acids (*pentenoic acid*).
  Ethylanilinoquinonedicarboxylic acid.
  Ethylcitraconic acid.
  Ethylcitrapyrotartaric acid.
  Ethylcyanoacetic acid.
  Ethylenesulphonic acid.
  Ethylenetetracarboxylic acid.
  Ethylenethiolcarbamic acid.
  α-Ethylglyceric acid.
  Ethylidenebismalonic acid (*butanetetracarboxylic acid*).
  Ethylidenediacetic acid (*β-methylglutaric acid*).
  Ethylidenediacetoacetic acid.
  Ethylidenemalonic acid.
  Ethylidenephthalimidylacetic acid.
  Ethylitaconic acid.
  Ethylitapyrotartaric acid.
  Ethylmalonic acid.
  Ethylmesaconic acid.
  Ethylnaphthindolinonequinonecarboxylic acid.
  Ethylnitrolic acid.
  Ethylparaconic acid.
  Ethylphosphinic acid.
  Ethylphosphinous acid.
  d-Ethylsantonous acid.
  Ethylsuccinic acid.
  Ethyl*tri*thiocarbonic acid.
  Euchroic acid.
  Everninic acid.
  Fabianaglucotannoid.
  Fencholenic acid.
  Ferulic acid.
  Formhydroxamic acid.
  Formic acid.
  Formylcyanoacetic acid.
  Fumaric acid.
  Furfuryldimethylethylenelactic acid.
  Furfurylidenediacetoacetic acid.
  Furfurylidenemalonic acid.

Acids. See :—
  Furfurylmethyl*cyclo*hexenonecarboxylic acid.
  Galbanic acid.
  Gallic acid.
  Gallotannic acid.
  Gelsemic acid.
  Geranic acid.
  Gluconic acid.
  Glutaconic acid.
  Glutamic acid.
  Glutaric acid.
  Glyceric acid.
  Glycerophosphoric acid.
  Glycidic acids.
  Glycocholic acid.
  Glycollic acid.
  Glycosyldihydroxycinnamic acid.
  Glycuronic acid.
  Glyoxylic acid.
  Granatic acid.
  Graphitic acid.
  Guanidineglyoxylic acid.
  Guanidinepyruvic acid.
  Guanylic acid.
  Gyrophoric acid.
  Hæmatic acids.
  Hemellithylic acid.
  Hemimellitic acid.
  Hemipinic acids.
  Heptadecylcarbamic acid.
  cyclo-Heptanecarboxylic acid.
  Heptanedicarboxylic acids.
  n-Heptane-mono- and -di-sulphonic acids.
  Heptanetetracarboxylic acid (*isoamylidenebismalonic acid*).
  δ- and γ-*cyclo*-Heptatrienecarboxylic acids.
  Δ^1-*cyclo*-Heptenecarboxylic acid.
  Heptenoic acids.
  Heptoic acid.
  Heptylidenebismalonic acid.
  Heptylsuccinic acid.
  cyclo-Hexadienecarboxylic acid.
  cis-Hexahydro-*o*-toluic acid.
  Hexahydro-xylic acid.
  Hexanaphthenecarboxylic acid.
  Hexanedicarboxylic acids.
  n-Hexane-mono- and -di-sulphonic acids.
  Hexanetetracarboxylic acid.
  Hexanetricarboxylic acids.
  Hexenoic acid.
  Hexoic acid.
  Hexyl*iso*aconic acid.
  Hexylaticonic acid.
  Hexylcitraconic acid.
  Hexylenedicarboxylic acid (*dimethylallylmalonic acid*).
  β-Hexylglutaric acid.
  Hexylitaconic acid.

Acids. See :—
Hexylmesaconic acid.
Hexylparaconic acid.
Hexyl*iso*paraconic acid.
Hippuric acid.
Homocamphoronic acid.
Homogentisic acid.
Homophthalic acid.
Homopiperonylic acid
Humic acid.
Hydratropic acid (*α-phenylpropionic acid*).
Hydrazobenzenecarboxylic acid
Hydrazoic acid.
Hydrazophthalaldehydic acid.
Hydrazopropionic acid.
Hydrocyanic acid.
Hydrodigitoic acid.
Hydrofluoranic acid.
Hydrosorbic acid (*hexenoic acid*).
Hydrotropilidinecarboxylic acid.
β-Hydroxy-α-*iso*amylbutyric acid (*hydroxynonoic acid*).
Hydroxybehenic acids.
Hydroxybenzaminocinnamic acid.
Hydroxybenzoic acids.
Hydroxybutanedicarboxylic acid (*β-hydroxyethylsuccinic acid*).
α-Hydroxybutenoic acid (*vinylglycollic acid*).
β-Hydroxybutyric acid.
Hydroxy-*cis*-π-camphanic acid.
γ-Hydroxydiethylacetoacetic acid.
β-Hydroxy-αα-diethylglutaconic acid.
Hydroxydihydrocampholytic acid.
Hydroxydimercuracetic acid.
γ-Hydroxydimethylacetoacetic acid.
Hydroxydimethylbenzoic acid.
Hydroxydimethylglutaric acids.
Hydroxydiphenylacetic acid.
Hydroxydiphenylmethanecarboxylic acid.
Hydroxydiphenylpyridinecarboxylic acid.
β-Hydroxyethanesulphonic acid.
Hydroxyethanetricarboxylic acid.
Hydroxyethylenesulphonic acid (*isethionic acid*).
β-Hydroxyethylsuccinic acid.
Hydroxyfenchenic acid.
Hydroxygluconic acid.
β-Hydroxyglutaric acid.
2-Hydroxyhexahydro-*o*-toluic acid.
2-Hydroxy-$\Delta^{2'4}$-hydropyridone-3-carboxylic acid.
Hydroxymenthylic acid.
α-Hydroxy-α-methyl-β-*iso*amylsuccinic acid.
Hydroxymethoxyphenylglyoxylic acid.
Hydroxymethyldibenzylcarboxylic acid.

Acids. See :—
Hydroxymethyldiphenylmethanecarboxylic acid.
Hydroxymethylenecyanoacetic acid.
β-Hydroxy-αα-methylethylglutaconic acid.
Hydroxymethyl*cyclo*hexanecarboxylic acid.
Hydroxymethyl*iso*propyladipic acid.
ω-Hydroxymethylpyromucic acid.
Hydroxymethylsuccinic acid.
Hydroxymethylterephthalic acid.
Hydroxynaphthaquinonesulphonic acid.
Hydroxynaphthoic acid.
Hydroxynonoic acid.
Hydroxyoctenoic acid.
Hydroxyparaconic acid.
Hydroxypentanedicarboxylic acid (*β-hydroxypropylsuccinic acid*).
Hydroxyphenoxyacetic acid.
Hydroxyphenylglyoxylic acid.
Hydroxyphenylmethylpyridinecarboxylic acid.
Hydroxyphenyloxamic acid.
Hydroxyphenylphosphoric acid.
Hydroxyphenyl-*ac*-tetrahydronaphthalenecarboxylic acid.
Hydroxyphthalamic acid.
Hydroxyphthalic acid.
Hydroxypiperidiniumacetic acid.
Hydroxypropanedicarboxylic acid (*hydroxymethylsuccinic acid*).
Hydroxypropylsuccinic acids.
Hydroxypyrotartaric acid (*hydroxymethylsuccinic acid*).
Hydroxypyruvic acid.
Hydroxystearic acids.
Hydroxysuccinic acid.
Hydroxy*iso*terebic acid.
Hydroxyterpenylic acid.
β-Hydroxytetramethylglutaric acid.
Hydroxythiodiazolesulphonic acid.
3-Hydroxytriazole-5-carboxylic acid.
Hydroxytrimethylgallic acid.
Hydroxytrimethylsuccinic acid.
Hydroxyvaleric acid.
Hydroxy-xylic acid.
Hydurinephosphoric acid.
Hyponitrosoacetic acid.
Iminophenylcarbamic acid.
Indigotinsubsulphonic acids.
Indonecyanoacetic acid.
Indonemalonic acid.
Indoxylsulphuric acid.
Isaconitic acid.
Isatoic acid.
Itaconic acid.
α-Ketobutenoic acid (*propionylformic acid*).
Ketocoumarancarboxylic acid.
Ketovalerolactonecarboxylic acid

Acids. See :—
  Lactic acid.
  Lævulic acid.
  Latebraric acid.
  Lauric acid.
  iso-Lauronolic and ψ-Lauronolic acids.
  Lecanoric acid.
  Lecasteric acid.
  Lecidic acid.
  Lepraric acid.
  Leucine.
  Lichenostearic acid.
  Lichenosterylic acid.
  Lignoceric acid.
  Malachite-greensulphonic acid.
  Maleamic acid.
  Maleic acid.
  Malic acids.
  Malonic acid.
  Maltobionic acid.
  Maltodextrinic acid.
  Mandelic acid.
  Meconic acid.
  Melanurenic acid (*ammelide*).
  Mellitic acid.
  Mesaconic acid.
  Mesitylenic acid.
  Mesitylglyoxylic acid.
  Mesityloxidoxalic acid.
  Mesoxalic acid.
  Methanedisulphonic acid.
  Methanetricarboxylic acid.
  Methanetrisulphonic acid.
  Methenylbismalonic acid (*dicarboxyglutaconic acid*).
  Methoxybenzenesulphonic acid.
  p-Methoxybenzoylpropionic acid.
  Methoxycinnamic acid.
  Methoxydiphenylcarboxylic acid.
  Methoxygallic acid.
  Methoxymethylenecyanoacetic acid.
  Methoxymethylpropylbenzoic acid.
  Methoxymethylterephthalic acid.
  Methoxyphenylglyoxylic acid.
  Methoxyphenylmethyl*cyclo*hexenonedicarboxylic acid.
  Methoxyphenylpropiolic acid.
  Methoxypropionic acid.
  Methoxysuccinic acid.
  Methoxytoluenesulphinic acid.
  Methoxytoluenesulphonic acid.
  Methoxytricarballylic acid.
  Methoxy-xylic acid.
  Methylacetoacetic acid.
  Methylacetobutyric acid.
  Methylacetylsuccinic acid.
  Methylacrylic acid.
  Methyladipic acid.
  Methylaminocrotonoethylideneacetoacetic acid.
  Methyl*iso*amylmaleic acid.
  α-Methyl-β-*iso*amylsuccinic acids.

Acids. See :—
  Methylanilinopropionic acid.
  α-Methylanilino*iso*valeric acid.
  Methyl*iso*butylideneacetic acid.
  Methylcinnamic acid.
  Methylcrotonic acid (*tiglic acid*).
  Methyldeoxybenzoincarboxylic acid.
  Methyldibenzylcarboxylic acid.
  Methyldiethylbenzoic acid.
  Methyldihydrotrimesic acid.
  Methyldithiodiazolonesulphonic acid.
  Methyleneasparagine.
  Methylenedimalonic acid (*propanetetracarboxylic acid*).
  Methylenedioxycinnamic acid.
  Methylenedioxyphenylpropiolic acid.
  Methylenemalonic acid.
  Methylethylacetic acid (*valeric acid*).
  Methylethylacetoacetic acid.
  Methylethylallylmalonic acid.
  Methylethylbenzimidazolonecarboxylic acid.
  Methylglutaric acids.
  Methylgranatic acid.
  Methyl*cyclo*hexanecarboxylic acid.
  Methyl*cyclo*hexenecarboxylic acid.
  Methylhexenoic acid.
  Methylhexenonepyruvic acid.
  Methylhydroresorcylic acid.
  Methylhydroxyethylaminoacetic acid.
  Methylindoleacetic acid.
  Methylindolecarboxylic acid.
  Methylitaconic acid.
  α-Methyllactic acid.
  Methylmalic acid.
  Methylmalonic acid (iso*succinic acid*).
  Methylmesaconic acid.
  α-Methyl-β-naphthacinchonic acid.
  2-Methyl-2-nonene-6-onoic acid.
  Methyl*cyclo*pentanedionedicarboxylic acid.
  Methylphenylalanine.
  Methylpropanetetracarboxylic acid.
  α-Methyl-β-propyllactic acid.
  Methylpyrrolidinedicarboxylic acid.
  Methylpyrrylacetic acid.
  Methylsalicylidenediacetoacetic acid.
  Methylsalicylidenemalonic acid.
  Methylstilbenecarboxylic acid.
  Methylsuccinic acid.
  Methyltartronic acid.
  Methylterephthalic acid.
  Methyltetrahydrotrimesic acid.
  Methyltoluidinesulphonic acid.
  Methyltoluylenehydratecarboxylic acid.
  Methyltriazencarboxylic acid.
  Methylxanthic acid.
  Mucic acid.
  Mucobromic acid.
  Mucochloric acid.
  Myristic acid.

Acids. See :—
Naphthalenedisulphonic acid.
α-Naphthaleneindigotinsulphonic acids.
Naphthalenesulphin-sulphonic and -disulphonic acids.
Naphthalenetrisulphonic acid.
Naphthaquinoneacetoacetic acid.
Naphthaquinoneaminosalicylic acid.
Naphthaquinonecyanoacetic acid.
Naphthaquinonedicyanoacetic acid.
Naphthaquinoneimidesulphonic acid.
Naphthaquinonemalonic acid.
Naphthasultonesulphonic acid.
Naphthenic acids.
Naphthoic acid.
Naphthol-sulphonic and -disulphonic acids.
Naphthylacrylic acid.
Naphthylaminesulphonic acid.
Naphthyldithiocarbazinic acids.
Naphthyldithiazolonesulphonic acid.
Naphthylpropylenecarboxylic acid.
Naphthylsulphonebutyric acids.
Nasturtiic acid.
Nicotinic acid.
Nonanedicarboxylic acid (*heptylsuccinic acid*).
Nonanedicarboxylic acid (*β-hexylglutaric acid*).
Nonanetetracarboxylic acid (*heptylidenebismalonic acid*).
Nonoic acid.
Noryohimbic acid.
α- and *b*-Nucleic acids.
Nucleothymic acid.
Octanedicarboxylic acid.
n-Octane-mono- and -di-sulphonic acids.
Octinoic acid.
Octoaspartic acid.
Octoic acid.
Octylenedicarboxylic acid.
Octyl-β-naphthacinchonic acid.
Oenanthylidenebismalonic acid (*heptylidenebismalonic acid*).
Oleic acid.
Orcinol-di-, and tri-carboxylic acids.
Ornithuric acid (*dibenzoylornithine*).
Ovalbuminic acid.
Oxalacetic acid.
Oxalic acid.
Oxydigitogenic acid.
"Oxyheptic acid" (*isopropylmesaconic acid*).
Oxyprotosulphonic acid.
Oxyroccellic acid.
Palmitic acid.
Paraconic acid.
Parapyruvic acid.
Parellic acid.
Parellinic acid.

Acids. See :—
Parmelialic acid.
Pentadecylcarbamic acid.
Pentadecyl*di*thiocarbamic acid.
Pentanedicarboxylic acids.
Pentanetetracarboxylic acid.
Pentanetricarboxylic acid.
Pentenoic acids.
Pentonic acid.
Pentylenedicarboxylic acids.
Peroxyprotoic acid.
Pertusaric acid.
Phenacylcinnamic acid.
Phenacylcyanoacetic acid.
Phenacylhydrocinnamic acid.
Phenacyllævulic acid (*phenyl*-4 : 7-*diketohexanecarboxylic acid*).
Phenacylmethylcinnamic acid.
Phenethylsuccinic acid.
Phenetoilsulphinic acid.
Phenetoilsulphonic acid.
Phenoxyacetic acid.
Phenoxybenzene-*p*-sulphonic acid.
Phenylacetamidocinnamic acid.
Phenylacetamidophenylpropionic acid.
Phenylacetic acid.
Phenylacetoacetic acid.
Phenylacetobutyric acid.
Phenylacrylic acids.
Phenylalanine.
Phenylanilinoglutaric acid.
Phenyl-*p*-anisidoacetic acid.
Phenylaticonic acid.
Phenylazochromotropic acid.
Phenylazoglutaconic acid.
Phenylbenzylbutyrolactoneacetic acid.
α-Phenylbenzyl*iso*crotonic acid.
Phenylbenzylcrotonolactoneacetic acid.
Phenylbenzylglutaconic acid.
Phenylbenzylglycine.
γ-Phenyl-β-benzylidene-α-ketobutyric acid.
Phenylbenzylidenepyrotartaric acid.
Phenylbenzylpropylenetricarboxylic acid.
Phenylbenzylthioallophanic acid.
Phenylbutanetricarboxylic acid.
Phenylbutyric acid.
Phenylbutyrolactoneacetic acid.
Phenylcarbamic acid.
Phenylcarbazinic acid.
Phenylcarboxyglutaconic acid.
Phenylcinnamenylacrylic acid.
Phenylcitraconic acid.
Phenyl-*p*-cresylethoxyacetic acid.
Phenyl*iso*crotonic acid.
Phenyldihydro*iso*lauronolic acid.
Phenyldihydronaphthoic acid.
Phenyl-4 : 7-diketohexanecarboxylic acid.
Phenyldiketo*cyclo*hexanedicarboxylic acid.

Acids. See :—
Phenyldiketophenoheptamethylenedicarboxylic acid.
Phenyldiketopiperidinecarboxylic acid.
Phenyldimethyl*iso*oxazoleacetic acid.
Phenyldithiocarbazinic acid.
Phenyldithiodiazolonesulphinic acid.
Phenylenedimethylcarbamidecarboxylic acid.
o-Phenylenedioxydiacetic acid.
Phenylenediphosphoric acid.
Phenylethoxyacetic acid.
Phenylethylpropionic acid.
Phenylethylsalicylic acid.
Phenylethylthioallophanic acid.
Phenylglutaconic acid.
Phenylglutaranilic acid.
Phenylglutaric acid.
Phenylglutarocarboxylic acid.
Phenylglutarodiethylamidocarboxylic acid.
Phenylglutaropiperididocarboxylic acid.
Phenylglycollic acid.
Phenylhydrazinedicarboxylic acid.
Phenylhydrazinoformic acid.
Phenylhydrazinoacetic acid.
Phenylhydroresorcylic acid.
Phenylhydroxypivalic acid.
Phenyliminophenylcarbamic acid.
Phenylitaconic acid.
Phenyllactic acid.
Phenylmalonic acid.
Phenylmesaconic acid.
Phenylmethoxyacetic acid.
Phenylmethylaconic acid.
Phenylmethylenepyrotartaric acid.
Phenylmethylethylenelactic acid.
Phenylmethyl*cyclo*hexenone-carboxylic and -dicarboxylic acids.
Phenylmethylitaconic acids.
Phenylmethylparaconic acid.
Phenylmethylpropionic acid.
Phenylmethylpyrazolephosphinic acid.
Phenylmethylpyridonecarboxylic acid.
Phenylmethylpyronecarboxylic acid.
Phenylmethylpyrotartaric acid.
Phenylmethylsalicylic acid.
Phenylmethylthioallophanic acid.
Phenyl*cyclo*-pentanedionedicarboxylic acid.
Phenyl-α′-phenylpyronecarboxylic acid.
Phenylphosphoric acid.
Phenylpropanetricarboxylic acid.
Phenylpropenylmalonic acid.
Phenylpropiolic acid.
Phenylpropiolohydroxamic acid.
α-Phenylpropionic acid.
Phenyl*iso*propoxyacetic acid.
Phenylpropylenetricarboxylic acid.
Phenyl*iso*propylethylenelactic acid.

Acids. See :—
Phenylpropylidenemalonic acid.
Phenylpropyloxyacetic acid.
Phenylpyrazolonecarboxylic acid.
γ-Phenyl-α-pyrone-α′β′-dicarboxylic acid.
Phenylquinolinecarboxylic acid.
o-Phenylsalicylic acid.
Phenylsarcosine.
Phenylsemicarbazideacetoacetic acid.
Phenylsemicarbazidecarboxylic acid.
Phenylstibic acid.
Phenylsulphone-*n*- and -*iso*-butyric acids.
Phenylsulphonesodioacetic acid.
Phenyltartronic acid.
1-Phenyl-*ac*-tetrahydronaphthalene-3-carboxylic acid.
Phenylthiocarbazinic acid.
Phenylthiohydantoic acid.
α-Phenyl*di*thio-C-methylketuretcarboxylic acid.
Phenyltolyltoluic acid.
Phenyltrimethacetobutyric acid.
Phenylxylylketoximecarboxylic acid.
Phloroglucinoltricarboxylic acid.
Phoronediacetic acid.
Phthalamic acid.
Phthalamidobenzoic acid.
Phthalanilic acid.
Phthalic acids.
Phthalimidobutylmalonic acid.
Phthalophenylamic acid.
Phthalyloxybenzoic acids.
Phthalylphenyl*iso*crotonic acid.
Phthalylsalicylic acid.
Picramic acid.
Picrotoxic acid.
Pimelic acid.
Piperic acid.
Piperidinoacetic acid.
Piperidylacetic acid.
α-Piperidylbutyric acid.
γ-Piperidyldimethylacetoacetic acid.
Piperidylmaleic acid.
α-Piperidylopropionic acid.
α-Piperidyl*iso*valeric acid.
Piperonylidenediacetoacetic acid.
Piperonylidenemalonic acid.
Piperonylmethyl*cyclo*hexenonedicarboxylic acid.
Plumieridic acid.
Polystichic acid.
Prehnitolcarboxylic acid.
cyclo-Propanecarboxylic acid.
cyclo-Propanedicarboxylic acid.
Propanedicarboxylic acid.
Propanepentacarboxylic acid.
Propanetetracarboxylic acid.
Propanetricarboxylic acids.
Propionic acid.
Propionylformic acid.

Acids. See :—
Propionylhydroxypropionic acid.
Propionylmalic acid.
o-Propiophenonecarboxylic acid.
n- and *iso*-Propylacetoacetic acids.
β-*iso*-Propylacetobutyric acid.
Propylacrylic acids (*hexenoic acids*).
Propylbenzenesulphonic acids.
Propylbenzoic acid.
β-*iso*-Propylbutyric acid (*heptoic acid*).
Propylcacodylic acid (*dipropylarsinic acid*).
Propylcitraconic acids.
Propylenedicarboxylic acid.
iso-Propylenemalonic acid.
Propylenetetracarboxylic acid.
Propylenetricarboxylic acid.
iso-Propylglutaric acids.
Propylglyceric acids.
Propylidenedicarboxylic acid.
Propylidenetricarboxylic acid.
Propylitaconic acids.
Propylmalonic acid.
Propylmesaconic acids.
Propylnitrolic acid.
Propylparaconic acids.
Propylphenylmethyl*cyclo*hexenonedicarboxylic acid.
iso-Propylphenylpivalic acid.
n- and *iso*-Propylphosphinic acids.
n- and *iso*-Propylphosphinous acids.
n- and *iso*-Propylsuccinic acids.
Protocatechuic acid.
Protocetraric acid.
Pulegone, hydrosulphonic acids of.
Pulveraric acid.
Pyrazoledicarboxylic acid.
Pyridazine-3-carboxylic acid.
Pyrimidinecarboxylic acid.
Pyrocinchonic acid.
Pyromeconic acid.
Pyromucic acid.
Pyromucylacetic acid.
Pyrotartaric acid.
Pyruvic acid.
Quinic acid.
Quinoldicarboxylic acid.
Quinolinecarboxylic acid.
Quinonedicarboxylic acid.
Racemic acid.
Rhizocarpic acid.
Rhizocarpinic acid.
Rhizonic acid.
Rhizoninic acid.
Ricinoleic acid.
Roccellic acid.
Rosanilinesulphonic acid.
Saccharic acid.
iso-Saccharinic acid.
Salazinic acid.
Salicylic acid.
Salicyl-O-phosphinic acid.

Acids. See :—
Salol-O-phosphinic acid.
Santalylphthalic acid.
Santonic acid.
Santonous acids.
Scatoleacetic acid.
Sebacic acid.
Semiorthoxalic acid.
Semiphenylhydrazoneoxalic acid.
Semi-*p*-tolylimino-oxalic acid.
Sodiophenylacetoacetic acid.
Stearic acid.
Stereocaulic acid.
Strychnic acid.
Suberic acid.
Succinamic acid.
Succinanilic acid.
Succinic acids.
Succinobenzylamic acid.
Sulphacetic acid.
o-Sulphamidobenzoic acid.
Sulphanilic acid.
Sulphobenzoic acid.
Sulphocamphylic acid.
Sulphocarbanilic acid.
Sulphomethyltriazancarboxylic acid.
Sulphonalphthalamic acid.
Sulphophenylaminopyrazolonecarboxylic acid.
Tannic acid.
Tartaric acid.
Tartrazinogenic acid.
Taurocholic acid.
Tartaric acid.
Teraconic acid.
Terebic acids.
iso-Terebilenic acid.
Terephthalic acid.
Terpenylic acid.
Tetracetylmucic acid.
Tetraspartic acid.
Tetrazodiphenyldicarboxylic acid.
Tetrahydrodicampherylic acid.
Tetrahydro*iso*lauronic acid.
Δ^2-Tetrahydro-*o*-toluic acid.
Tetrahydrouvitic acid.
Tetrahydro-xylic acid.
Tetramethyl*di*aminodiphenylmethanedimethylaminohydroxyphenoxazonecarboxylic acid.
Tetramethylenecarboxylic acid (cyclo*butanecarboxylic acid*).
Tetramethylenedicarboxylic acid (cyclo*butanedicarboxylic acid*).
Tetramethylpyrroline-*β*-carboxylic acid.
Tetric acid.
Thamnolic acid.
Thiazyl*iso*butyric acid.
Thioallophanic acid.
Thiocarbonylphenylcarbazinic acid.
Thiodiazoledisulphonic acid.

Acids. See :—
  Thioglycollic acid.
  Thiophanic acid.
  Thiophaninic acid.
  Thymolglycuronic acid.
  Thymolsulphonic acids.
  Tiglic acid.
  Toluenesulphonacetic acid.
  Toluenesulphoneacetoacetic acid.
  Toluenesulphonomalonic acid.
  Toluic acid.
  p-Toluidido-oxalic acid.
  Toluidinesulphonic acids.
  Toluidinoacetic acid.
  Toluylmalic acid.
  Toluyltartaric acid.
  Tolylacetic acid.
  Tolylaminoacetic acid.
  Tolylcarbamic acid.
  Tolyldithiocarbazinic acid.
  p-Tolyldithiodiazolonesulphonic acid.
  Tolylglyoxylic acid.
  Tolylhydroxynaphthazinedisulphonic acid.
  Tolylimidotolycarbamic acid.
  Tolylnaphthindolinonequinonecarboxylic toluidide.
  p-Tolyloxybutyric acid.
  Tolylphosphinic acid.
  Tolylphosphinous acid.
  Tolylsuccinic acid.
  Tolylsulphonebutyric acids.
  Triacetyl*di*amidonaphtholsulphonic acid.
  Triazolecarboxylic acid.
  2 : 4 : 6-Triethylbenzoic acid.
  Triglycolamic acid.
  Trihydroxyglutaric acid.
  Trimellitic acid.
  Trimercuracetic acid.
  Trimesic acid.
  Trimethoxybenzoylbenzoic acid.
  Trimethoxydiphenylmethanecarboxylic acid.
  Trimethoxy-α-methylcinnamic acid.
  Trimethylacetic acid.
  Trimethylacetylsuccinic acid.
  Trimethylenecarboxylic acid (*cyclopropanecarboxylic acid*).
  Trimethylenedicarboxylic acid (*cyclopropanedicarboxylic acid*).
  Trimethylgallic acid.
  αββ-Trimethylglutaranilic acid.
  αββ-Trimethylglutaric acid.
  Trimethylphosphortolubetainecarboxylic acid.
  Trimethylpyruvic acid.
  Trimethylsuccinic acid.
  Trimethyluric acid.
  Triphenylacetic acid.
  Triphenylglutaric acid.
  Triphenylpyrazolecarboxylic acid.

Acids. See :—
  Triphenyltrimesic acid.
  Tropæolic acid.
  Tyrosine.
  Umbilicaric acid.
  Undecoic acid.
  Undecylcarbamic acid.
  Uric acid.
  Usnic acid.
  Uvitic acid.
  Valeric acids.
  iso-Valerylcyanoacetic acid.
  iso-Valerylmalic acid.
  Vanillic acid.
  Vanilloylcarboxylic acid.
  Veratric acid.
  Vinylacetic acid.
  Vinylglycollic acid.
  Violuric acid (*isonitrosobarbituric acid*).
  Vulpic acid.
  Xylenesulphinic acid.
  p-Xylic acid.
  Xylidinesulphonic acids.
  Xylylcarboxylic acid.
  Xylylglyoxylic acids.
  Xylylic acid.
  Yohimbic acid.
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  - Acetylcarbinol.
  - α-Acetylpropylic alcohol.
  - Allylic alcohol.
  - Amylenic glycols.
  - Amylic alcohols.
  - Amylphenols.

Alcohols and Phenols. See also :—
  p-Anhydrohydroxylaminobenzylic alcohol.
  Anhydro-α-naphthaquinoneresorcinol.
  2-Anisylideneacetyl-1-naphthol.
  Anthragallol.
  Benzenyl-*p*-cresol.
  Benzoylcreosol.
  Benzoylmethylcreosol.
  Benzyldihydrocarvol.
  Benzylguaiacol.
  Benzylic alcohol.
  Benzylmenthol.
  Benzylpulegol.
  Borneols.
  Butylbenzylic alcohol.
  αγ-Butylenic glycol.
  Butylic alcohols.
  Butylphenol.
  Camphenilol.
  Caparrapiol.
  iso-Caprylic alcohol (*octylic alcohol*).
  Carvacrol.
  Catechol.
  Catechol ethylenic ether carbinol.
  Cholesterols.
  Cineol.
  Cresols.
  Cresolquinone.
  Cresolphenolquinone.
  Cresylaniline.
  Cresylpiperidine.
  Decanaphthenol.
  Decylic alcohol.
  p-Desylphenol.
  Desylthymol.
  Diacetamido-β-naphthol.
  Diacetylene glycol.
  Diacetylphloroglucinol.
  Diamylic alcohol (*decylic alcohol*).
  Diamylresorcinol.
  Dibutylcatechol.
  Dibutylpyrogallol.
  Dibutylresorcinol.
  Dicarveol.
  γ-Diethylamino-αβ-propylenic glycol.
  Diethylcarbinol (*amylic alcohol*).
  Diethylphenol.
  Dihydroresorcinol.
  Dihydroxydibenzylmesitylene.
  Dihydroxydiketonaphthadihydropyrazole.
  Dihydroxyflavone.
  Dihydroxynaphthaquinonediphenylmethane.
  Dihydroxynaphthaquinonetetramethyl*di*aminodiphenylmethane.
  Dihydroxypicoline.
  γ-Dimethylamino-αβ-propylenic glycol.
  Dimethylethylcarbinol (*amylic alcohol*).

Alcohols and Phenols. See also :—
  Dimethylethyl*cyclo*hexanol.
  Dimethylheptenol.
  Dimethylhydroresorcinol.
  Dimethylphloroglucinol.
  Dinaphthols.
  Dipentamethenylpinacone.
  Diphenylcarbinol.
  Diphenyldihydroxynaphthylmethane.
  Dipiperidylbutylic alcohol.
  Dipropenylic glycol.
  Estragol.
  o-Ethoxy-2-benzylideneacetyl-1-naphthol.
  Ethoxycarbonylphenol.
  Ethoxyphenol.
  Ethylacetamidophenol.
  γ-Ethylamino αβ-propylenic glycol.
  Ethylenic glycol.
  Ethylic alcohol.
  Ethylphenol.
  Eucarvone.
  Eugenols.
  Fenchylic alcohol.
  Furfurylic alcohol.
  2-Furfurylideneaceto-2-naphthol.
  Furylhydroresorcinol.
  Geraniol.
  Glycerol.
  Glycide.
  Guaiacol.
  Heptylic alcohol.
  Hexamethylphloroglucinol.
  cylco-Hexanol.
  Hydrindeneglycol.
  Hydrocinnamoin.
  Hydroresorcinol.
  Hydroxyanthranol.
  Hydroxychalkone.
  Hydroxy-ψ-cumylic alcohol.
  Hydroxyfluorene alcohol.
  p-Hydroxymesitylic alcohol.
  Hydroxymethylanthranol.
  Hydroxyphenyldimethylpyrimidine.
  Hydroxyphenylphthalazone.
  Hydroxyphenylphthalide.
  Ilicic alcohol.
  r-Inositol.
  iso-Lauronolic alcohol.
  Lecidol.
  Lemonol (*geraniol*).
  Licareol.
  Licarhodol.
  Linalool.
  Menthanediol.
  Menthanetetrol.
  Menthol.
  Methebenol.
  Methylacetobutylic alcohol.
  γ-Methylamino-αβ-propylenic glycol.
  3-Methylbenzhydrol.
  1′-Methyl-3′-3′-diethylindolinol.

Alcohols and Phenols. See also :—
Methylenedi-*p*-anhydroaminobenzylic alcohol.
Methylheptenol.
Methylhydroresorcinol.
Methylic alcohol.
Methyloldimethylnaphthalene.
Methylphloroglucinol.
Methyl*iso*propene*cyclo*hexenol.
Methylpropylcarbinols (*amylic alcohols*).
Methylpyrogallol.
Morphenol.
Morphol.
Naphthaquinonetetramethyl*di*aminodiphenylcarbinol.
o-Naphtheneglycol.
Naphthol.
Nonenylic alcohol.
Nopinolglycol.
Octylic alcohol.
Octylic glycol.
Orcinol.
Pentadecylic alcohol.
Pentamethylphloroglucinol.
cyclo-Pentanediol.
cyclo-Pentanol.
Phenol.
Phenolsaccharein.
Phenolthymoquinone.
Phenoltoluquinone.
o-Phenylbenzylic alcohol.
Phenylhydroresorcinol.
Phenyl-3-methylanthranol.
Phenylmethylcarbinol.
Phenylmethyl*cyclo*hexanol.
Phenylmethyloxanthranol.
Phloroglucinol.
Phytosterol.
Pinolglycol.
Pinolol.
Piperidylcarbinol.
Polystichinol.
Propargylic alcohol.
Propylenic glycol.
Propylic alcohols.
p-Propylphenol.
iso-Propylphenylmethyl*cyclo*hexanol.
Pyrogallol.
Quinol.
Quinolbisdiphenylmethane.
α-Quinolylbutanetriol.
Quinolylethanol.
Quinolylpropandiols.
Resorcinol.
Resorcinolsaccharein.
Rhodinol.
Saligenin.
Santalol.
Santonin.
Sobrerythritol.
Stilbenediol.

Alcohols and Phenols. See also :—
Terpineol.
Tetramethyl*di*aminotriphenylcarbinol.
Tetramethyloctodecatetrenediol.
Tetramethylphloroglucinol.
Tetraphenyl*cyclo*pentanediol.
Tetrethylphenol.
Thymol.
Thymolphenolquinone.
Tolyl-3-methylanthranol.
Tolylmethyloxanthranol.
Trihydroxyheptane.
Trihydroxypicoline.
Trimethylbenzimidazolinol.
Trimethylcarbinol (tert. *butylic alcohol*).
Trimethylene-ethylenic glycol.
Trimethylenic glycol.
Trimethylethylenic glycol (β-iso-*amylenic glycol*).
Triphenylcarbinol.
Triphenyl*cyclo*pentanediol.
Triphenylvinylic alcohol.
n-Undecylic alcohol.
Vinylic alcohol.
o-Vinylphenol.
p-Xylenol.
Xylenolcarbinol.

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Aldol.
Asarylic aldehyde.
Benzaldehyde.
iso-Butaldehyde.
Butylbenzaldehyde.
iso-Butyraldol.

Aldehydes. See also :—
  Catecholglyoxal.
  Chloral.
  Cinnamaldehyde
  Citrals.
  Citriodoraldehyde.
  Citronellaldehyde (*citronellal*).
  Cuminaldehyde.
  Dimethylbenzaldehyde.
  Dimethylsalicylaldehyde.
  Ethaneprotocatechuic aldehyde.
  Ethoxynaphthaldehyde.
  Formaldehyde.
  Furfuraldehyde.
  Geranial.
  Glyceraldehyde.
  Glycollic aldehyde.
  Glyoxal.
  Hydralcellulose.
  Hydroxybenzaldehyde.
  Hydroxydiethylbenzaldehyde.
  Hydroxyfurfuraldehyde.
  Hydroxynaphthaldehyde.
  iso-Lauronolic aldehyde.
  *allo*Lemonal.
  Licarhodal.
  Malonic aldehyde.
  Mesitylaldehyde.
  Methoxycoumaraldehyde.
  Methoxynaphthaldehyde.
  Methylaldimethylnaphthalene.
  4-Methylfurfuraldehyde.
  Methyloctenonal.
  Methylphenylacetaldehyde.
  Methyl*iso*propylbenzaldehyde.
  Naphthaldehyde.
  Paraldehyde.
  Phenylbenzaldehyde.
  Piperidoaldehyde.
  Propaldehyde.
  Propylvaleraldehyde.
  Quinolinealdehyde.
  Salicylaldehyde.
  Tolualdehyde.
  Tolylbenzaldehyde.
  Trimethoxybenzaldehyde.
  Valeraldehydes.
  Vanillin.
  Veratric aldehyde.
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  Aconitine.
  Anagyrine.
  Anhalamine.
  Anhalonine.
  Anhydroecgonine.
  Atropine.
  apo-Atropine.
  Atroscine.
  Bebeerine.
  Belladonnine.
  Berberine.
  Brucine.
  Buxine.
  Caffeine.
  allo-Caffeine.
  Cascarilline.
  Choline.
  Cinchonicine.
  Cinchonidine.
  Cinchonine.
  ε-Cinchonine.
  δ-Cinchonine.
  ψ-Cinchonine.
  α-*iso*-Cinchonine.
  apo-*iso*-Cinchonine.
  tauto-Cinchonine.
  Cocaine.
  Codeine.
  iso-Codeine.
  Conicine.
  Coniine.
  Creatinine.
  Cytisine.
  Damascenine.
  Delphinine.
  Deoxycaffeine.
  Deoxycinchonidine.
  Dihydrothebaine.
  iso-Dihydrothebaine.
  Duboisine.
  Ecgonine.
  Emetine.
Alkaloids. See also—
  Ethebenine.
  Eucaine.
  Granatonine.
  Hydrastine.
  Hydroecgonidine.
  Hyoscine.
  Hyoscyamine
  ψ-Hyoscyamine.
  Hypoxanthine.
  Laurotetanine
  Lophophorine.
  Lycorine.
  Meconine.
  Methebenine.
  Mezcaline.
  Morphine.
  Morphothebaine.
  Narceine.
  Narcotine.
  Nicotine.
  Oscine.
  Papaverine.
  Pelletierine.
  Pelosine (*bebeerine*).
  Piperine.
  Prothebenine.
  Quinidine.
  Quinine.
  Scopolamine (*hyoscine*).
  i-Scopolamine.
  Scopoline (*oscine*).
  Sekisanine.
  Solanine.
  Staphisagroidine.
  Staphisagroine.
  Strychnine.
  Tetrahydropapaveroline.
  Thebaine.
  Thebenine.
  Theobromine.
  Tropine.
  Veratrine.
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Amines. See also:—
 Acetyl-α-naphthylamine.
 Acetylphenylhydrazonecarbodiphenylamine.
 Acetyltrimethyl-*m*-phenylenediamine.
 Albamine.
 Allylamine.
 Allyldipropylamine.
 Amylamine.
 Aniline.
 Anisidine.
 Auramine.
 Benzaldehydine, amino-.
 Benzenylphenyleneamidine.
 Benzylallylamine.
 Benzylallylaniline.
 Benzylamine.
 Benzylaniline.

Amines. See also :--
Benzyl-*o*-anisidine.
Benzyldiethylamine.
Benzyldimethylamine.
Benzylethylenediamine.
α-Benzylhydroxylamine.
Benzylhydroxypropylamine.
Benzylideneaminoguanidine.
Benzylidene-*p*-anisidine.
Benzylideneazone, amino-.
Benzylidenebornylamine.
Benzylidene*iso*diphenylhydroxyethylamine.
Benzylidene-*m*-tolylenediamine.
Benzylidenexylidine.
Benzylmethylaniline.
Benzyl*iso*nitramine.
Benzylnitraniline.
Benzylpiperidine.
Benzylpropylamine.
Butylamines.
Butylnitramine.
Campholene, amino-.
α-Camphylamine.
Camphor, amino-.
Cannabinolactone.
Chitosamine (*glucosamine*).
Coniine.
Cresylaniline.
Cresylpiperidine.
β-Decanaphthenes, amino-.
Diamylamine.
Di*iso*amylamine.
Di*iso*amylidene-ethylenediamine.
Dianilinoquinone.
Dibenyl, amino-.
Dibenzylamine.
Dibenzylaniline.
Dibenzylethylenediamine.
Dibenzylidene-*m*-phenylenediamine.
Di*iso*butylamine.
Di*iso*butylidene-ethylenediamine.
Dicyanodiamidine, amino-.
Diethylamine.
Diethylaminobenzonitrile.
Diethylaniline.
Diethyldiaminodi-*o*-tolylmethane.
Diethylenetetramethylenetetramine.
β-Diethylhydroxylamine.
iso-Diethylnitramine.
Diethyl-*o*-phenetidine.
Diethyl-*m*-xylidine.
Dihydrocaroyldiamine.
Dihydronaphthaquinoneaminoguanidine.
Dihydroquinoneaminoguanidine.
Dihydroquinone*bis*aminoguanidine.
Dihydrophenylacridine, amino-.
Dihydroxydiphenylamine.
Dihydroxyethylamine.
Dihydroxylamine.
Dimethylamine.

Amines. See also :—
Dimethylaniline, amino-.
Dimethylanilinophenylmethane.
Dimethylbenzylideneaniline.
Dimethyldiaminodi-*o*-tolylmethane.
Dimethyleneditoluidine.
Dimethylindazole, amino-.
Dimethylnitramine.
Dimethyl-*o*-nitraniline.
αβ-Dimethylpropylamine (*amylamine*).
Dimethyltoluidine.
Dimethyltolylenediamine.
Dimethyl-*m*-xylidine.
Dioxymethylpurine, amino-.
Diphenacyldihydrophenanthrene, amino-.
Diphenyl, amino-.
Diphenylamidine.
Diphenylamine.
Diphenylbenzenylamidine, amino-.
Diphenyldibenzylketodimethylamine.
Diphenyldimethylethylenediamine.
Diphenylethylenediamine.
Diphenylhydroxyethylamines.
iso-Diphenylhydroxyethylamine.
Diphenylmethane, amino-.
Diphenylmethylamine.
Diphenylmethyleneaniline.
Diphenyltetrahydroglyoxaline.
Diphenyl-*o*-toluidine.
Diphenyltrimethylenediamine.
Dipropylamines.
Di*iso*propylaniline.
Dipropylhydroxylamines.
Dipropyl-*p*-nitraniline.
Di-*p*-tolyldimethylenediamine.
Ditolylphenylmethane, amino-.
Ditolyltrimethylenediamine.
Dixylylmethane, amino-.
Ethenyl*tri*aminonaphthalene.
Ethenylnaphthylenediamine.
Ethylamine.
Ethylaniline.
Ethyl*iso*butylamine.
Ethylenediamine.
Ethylideneaminoguanidine, amino-.
Ethylidenediphenamine.
Ethylidene-*p*-ditolamine.
Ethylidenehydroxybutylene-ethylenediamine.
iso-Ethylmethylnitramine.
Ethylnitramine.
Ethyl-*o*-phenetidine.
Ethylpropylnitramines.
Ethyltoluidine.
Ethyl-*m*-xylidine.
Fluoran, amino-.
Formoguanamine.
Glucosamine.
Glycollamine.
Guanidine, amino-.

Amines. See also :—
Heptamethylenediamine.
Heptylamine.
Hexadecylamine.
Hexamethylenediamine.
Hexamethylenetetramine.
Hexamethyl-*p*-leucaniline.
cyclo-Hexane, amino-.
Hexylamine.
α-Hydrindamine.
Hydroxyaniline.
Hydroxybenzylideneaminoguanidine.
Hydroxybenzylidenebornylamines.
o-Hydroxybenzylidenebromethylamine.
Hydroxybenzylnitraniline.
Hydroxy-*ψ*-cumylaniline.
Hydroxy-*ψ*-cumylpiperidine.
Hydroxydiphenylamine.
Hydroxyethylamine.
Hydroxyethyl-*p*-nitraniline.
Hydroxyethyl-*p*-toluidine.
Hydroxyhexylamine.
Hydroxylamine.
p-Hydroxymesitylaniline.
p-Hydroxymesitylpiperidine.
Hydroxy-*o*-phenylenediamine.
Hydroxyphenylmethylquinoline, amino-.
p-Hydroxy-*o*-xylylaniline.
p-Hydroxy-*o*-xylylpiperidine.
Indazole, amino-.
Mesitylamine.
δ-Methoxybutylamine.
Methylallylaniline.
Methylamine.
Methylaniline.
Methylbornylamine.
Methylbutylallylcarbinamine.
Methylbutylenediamine.
Methylene-bisaniline.
Methylene-bispiperidine.
Methylenedi-*p*-phenetidine.
Methylenediphenylhydroxylamine.
Methylethyl*iso*butylamine.
iso-Methylethylnitramine.
Methylgranatylamines.
Methylindazole, amino-.
Methylnitramine.
Methyl-*o*-nitraniline.
Methylnitrosaminotoluidine.
Methyl*cyclo*pentane, amino-.
Methylpropylbenzylideneaniline.
Methylpurine, amino-.
Methyltetrahydroquinoline.
Methyl-*o*-toluidine.
Methyltriazen, bisaminoimino-, amino-.
Methyltriazole, amino-.
Methylxylidine.
Methylxylylenediamine.
Naphthaphenazine, amino-.

Amines. See also :—
Naphthaquinone-bisaminoguanidine.
Naphtholaminoguanidine.
Naphthylamine.
Nonomethylenediamine.
Octomethylenediamine.
Oxypurine, amino-.
Pentadecylamine.
Pentane, amino-.
Phenantriazine, amino-.
α-Phenethylamine.
Phenetidine, amino-.
Phenylamylamine.
Phenylaniline.
Phenylbenzimidazole, amino-.
Phenylbenzoxazole, amino-.
Phenylbenzylcarbamyl-*o*-tolylguanidine.
Phenylbenzylglycine.
Phenylcamphoformenamine.
Phenyldimethylacridine, amino-.
Phenylenediamine.
Phenyldixylylmethane, amino-.
Phenylfurfurylamine.
Phenylhydroxylamine.
Phenylmethylethylosotriazole, amino-.
Phenylmethyl*cyclo*hexane, amino-.
Phenylmethyl*iso*propylmethylamine.
Phenylnitramine.
Phenyl-*m*(*p*)-oxytolimidazole, amino-.
Phenyl-*o*-phenylenebenzenylamidine, amino-.
Phenylpyridazine, amino-.
Phenyltolylenediamine.
Propylamine.
o-Propylaniline.
Propylenediamine.
iso-Propylethylnitramine.
iso-Propylmethylnitramine.
Propylnitramine.
Pyridine, amino-.
Tetrethyldiaminodi-*o*-tolylmethane.
Tetrahydronaphthylamine.
r-Tetrahydropapaverine.
Tetrahydroquinoline.
Tetramethyl*di*aminodiphenylmethane
Tetramethylbenzidine.
Tetramethyldiphenylethane, amino-.
Tetramethylenediamine.
Tetramethylenedi-*o*-phenylenediamine
Tetraphenylphenylenediamine.
Tetramethylthioaniline.
Thiophen, amino-.
Tolane, amino-.
Toluidines.
m-Tolylenediamine.
Tolylenemethyldiamine.
Tolylhydroxylamine.
Tolylidenenitraniline.
Tolylmethylnitramine.
δ-*p*-Tolyloxybutylamine.

Amines. See also:—
- *p*-Tolyl-*o*-phenylenebenzenylamidine, amino-.
- Tolylphenylenediamine.
- Triacetonamine.
- Triacetonylamine.
- Trianilinobenzene.
- Triazole, amino-.
- Tribenzylamine.
- Triethylamine.
- Trihydroxyethylamine.
- Trimethylamine.
- Trimethylene-ethylenediamine.
- Trimethylenetrianiline.
- Triphenylamine.
- Triphenylguanidine.
- Triphenylmethanes, amino-.
- Tripropylamine.
- Tritolylguanidine.
- *n*-Undecylamine.
- Xylidine.
- Xylylamine.
- Xylylmethylnitrosamine, amino-.

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  Allophanazide.
  Allophanylazobutyronitrile.
  p-Aminoazobenzenehydrobromide.
  Azotriazole.
  p-Azoxyanisoil.
  Azoxybenzene.
  Azoxyphenetoil.
  Benzaldehydine-azophenol.
  Benzamidoazoresorcinol.
  Benzeneazoacetic acid.
  Benzeneazoacetoacetic acid.
  Benzeneazodimethylindazole.
  Benzeneazodiphenylimidocarbamide.
  Benzeneazo-*p*-ethoxybenzeneazophenol.
  Benzeneazohydroxydimethylbenzoxazole.

Azo-compounds. See:—
  Benzeneazohydroxymethylbenzoxazole.
  Benzeneazohydroxyphenylmethylbenzoxazole.
  3'-Benzeneazoindazole.
  Benzeneazo-*p*-methoxybenzeneazophenol.
  Benzeneazomethylphloroglucinolazobenzene.
  Benzeneazophenol.
  Benzeneazostyrene.
  Benzenylazoxime.
  Benzoylazobenzene.
  Benzoyloxybenzeneazohydroxyphenylmethylbenzoxazole.
  Bisethylicacetoacetateazodiphenyldicarboxylic acid.
  Bisphenolazodiphenyldicarboxylic acid.
  iso-Butaldazine.
  iso-Butylideneazine.
  Butyramidoazobenzene.
  Diazoacetic acid.
  Diazoacetonitrile.
  Diazoaminoindazole.
  Diazoaminopyridine.
  Diazobenzene.
  iso-Diazobenzene-sodium.
  Diazobenzenesulphonic acid.
  Diazobenzoic acid.
  Diazodimethylindazole hydroxide.
  Diazoethane.
  Diazoguanidine.
  Diazoindazole hydroxide.
  Diazomethane.
  Diazosulphanilic acid.
  Diazotates.
  Diazotolueneimide.
  Diazotriazolecarboxylic acid.
  Diazouracils.
  Diazourethanes.
  Diazo-xyleneimide.
  Dibenzenylazoxime.
  Diethylaminophenylcyanazomethinephenyl.
  Diethyl-*o*-phenetidineazobenzene.
  Digallacylosazone.
  Dimethylaminophenylcyanazomethinephenyl.
  Dimethylindazoleazo-β-naphthol.
  Dimethyltolueneazammonium silver iodide.
  Diphenyltriazine.
  Disazo-dyes.
  Guanazylmethane.
  Guanidinecarboxylazide.
  Hydrazobenzene.
  Hydroxyazobenzene.
  Hydroxybenzylideneazine.
  α-Hydroxy*iso*butyramidoazobenzene.
  Indazoleazo-β-naphthol.

Azo-compounds. See :—
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  Indazolylazo-β-naphthol.
  Mesitylazodimethylindazole.
  Methoxybenzeneazophenol.
  p-Methoxybenzeneazophenylmethylbenzoxazole.
  β-Methyladipic acid, azide of.
  Methylazimino-xylene.
  Methylnitrosaminotolueneazonaphthylamine.
  Methylnitrosamino-*s*-xyleneazo-β-naphthylamine.
  Methyltriazoleazodimethylaniline.
  Methyltriazoleazo-β-naphthylamine.
  β-Naphtholazo-dyes.
  Naphthoylazomethylene.
  Phenantriazine.
  Phenylaziminobenzenes.
  Phenylazochromotropic acid.
  Phenylazoethane.
  Phenylazoglutaconic acid.
  Phenylazopentane.
  Phenylazopropane.
  Phenylazo-xylene.
  Phenylmethylbenzeneazo-5-pyrazolone.
  Picrylazo-α-xylene.
  Propionamidoazobenzene.
  Pyridineazoresorcinol.
  Saloloxyphosphazophenyl.
  Tetrazodianisyl.
  Tetrazodianisylsulphonic acid.
  Tetrazodiphenyldicarboxylic acid.
  3′-*o*-Tolueneazoindazole.
  Tolyl-ψ-aziminobenzene.
  Triazoleazodimethylaniline.
  Trimethylbenzimidazoleazonaphthylamine.
  iso-Valeramidoazobenzene.
  3′-*m*-Xylene-*p*-azo-3-methylindazole.
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  - Formose.
  - Galactose.
  - Glucose (*dextrose*).
  - Glycogen.
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  - *l*-Iditol.
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  - Maltodextrin.
  - Maltose.
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  Alizarin.
  Alizarin yellow A.
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  Anilinonaphthaphenosaffranine.
  Anilinophenyl*apo*saffranine.
  Anthragallol.
  Anthrapurpurin.
  Apigenin.
  Aplysiopurpurin.
  Archil.
  Aspidiophyll.
  Benzopurpurin.
  Benzopurin.
  Bilirubin.
  Biliverdin.
  Bilixanthin.
  Brazilin.
  Brazilein.
  Carrotene.
  Chlorophyll.
  Chrysin.
  Cochineal.
  Congo-red.
  Colouring matter of Cotton flowers.
  Curcumin.
  "Diamine pure blue."
  Dimethyldi*tert*butylindigotin.
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  Eosin.
  Erythrolaccin.
  Fisetin.
  Flavaniline.
  Flavescin.
  Gallacetophenone (*alizarin yellow C*).
  Gallein.
  Genistein.
  Gossypetin.
  Hæmatein.
  Hæmatin.
  Hæmatoxylin
  Hæmoglobin.
  Hesperitin.
  Indigotin.
  Lacmoid.
  Litmus.
  Luteolin.
  Maclurin.
  Melanins.
  Meldola's blue.
  Methylene blue.
  p-Methylmalachite-green.
  Methyl-violet.
  Morin.
  Myricetin.
  Naphthaphenosaffranine.
  β-Naphtholazo-dyes.
  α-Naphtholbenzein.
  Phenolphthalein.
  Phenylnaphthazonium.
  Phenylphenazonium.
  Phenyl*apo*saffranine.
  Phyllotaonin.
  Phylloxanthin.
  Poirrier's blue, C_4B.
  Purpurin.
  Pyrogallolsuccinein.
  Quercetin.
  Rhamnazin.
  Rhamnetin.
  Rhodamine.
  Rosaniline.
  Rosindone.
  Rosolic acid.
  Rottlerin.
  apo-Saffranone.
  Santalin.
  Scoparein.
  Scoparin.
  Substance, $C_{18}H_{11}O_{10}N_5$, from melanin.
  Sulph-hæmoglobin.
  Tetramethylindigotin.
  Thujetin.
  Tropæolin OO.
  Turmeric.
  Vitexin.
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  Pectinase.
  Pepsin.
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  Acetamidophenylic propylic ether.
  iso-Amylic *l*-amylic ether.
  Amylic cetylic ether.
  Anhydroindoneresorcinol ether.
  Benzoylphloroglucinol methylic ether (cotoin).
  Benzylic amylic, ethylic, methylic, phenylic, and propylic ethers.
  Butylic amylic ether.
  α-Camphylic phenylic ether.
  Catechol acetylenic, ethylenic and methylacetylenic ethers.
  Crotonylic ether.
  Diacetoxymethylic ether.
  Diacetylene glycol, dimethylic ether of.
  Dibutylresorcinol dibutylic ether.
  Dicatechol acetylenic ether.
  Diethoxybenzene.
  Diguaiacylic ethylenic ether.
  p-Dihydroxydimesitylic ether, diacetate.
  Dinaphthylic benzylidenic, ethylidenic, and di*iso*propylic ethers.
  Diphenoxyhexane.
  Diphenoxypentane.
  Diphenoxypropane.
  2-Ethoxybenzylideneresacetophenone, ethylic ether.
  Ethoxymethylethanecatechol.
  Ethylic allylic ether.
  Ethylic amylic ether.
  Ethylic butylic ether.
  Ethylic crotonylic ether.
  Ethylic β-diethylallylic ether.
  Ethylic ether.
  Ethylic hexylenic ether.
  Ethylic β-methylethylallylic ether.
  Glycerol diallylic, di*iso*amylic, diethylic, dimethylic, and dipropylic ethers.
  Glycineaminoether.
  Hydroxybenzylic ethylic and methylic ethers.
  Hydroxy-ψ-cumylic ether.
  Hydroxymesitylic ethylic ether.
  Hydroxyphenoxymethylacetal.
  p-Hydroxy-*o*-xylylic methylic ether.
  Indoneresorcinol ether.
  Methylenediguaiacol.
  Methylic allylic ether.
  Methylic amylic ether.
  Methylic crotonylic ether.
  Methylic ether.
  Methylic ethylic ether.
  Methylic propargylic ether.
  Methylic propylic ether.
  Methylpyrogallol dimethylic ether.
  Morphenol methylic ether.
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  Pentamethylphloroglucinol monomethylic ether.
  Peucedanin (*oreoselone methylic ether*).
  Phenoxybutylene.
  Phenoxyhexylene.
  Phenoxypentylene.
  Phenyldithiodiazolonethiol aminophenylic and -naphthylic ethers.
  Phenylguaiacol.
  Phenylic allylic ether.
  Phenylic benzylic ether.
  Phenylic guaiacylic ethylenic ether.
  Phloracetophenone ethylic and methylic ethers.
  Propylic amylic ether.
  p-Propylphenylic methylic ether.
  Propyltrihydroxyphenylic trimethylic ether.
  Pyrogallol dimethylic ether.
  Resorcinol monethylic ether.
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l-**Ethoxypropionic acid**, and methylic, ethylic, and metallic salts, specific rotations of (Purdie and Irvine), T., 486; P., **1899**, 74.

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- α-**Ethylcrotononitrile,** and dimethylamine derivative (Henry), A., i, 568.
- **Ethylcyanacetic acid,** ethylic salt (Hessler), A., i, 898.
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  Agoniadin.
  Amygdalin.
  Arbutin.
  Carvacrylglucoside.
  Cheiranthin.
  Cocaonin.
  Coniferin.
  Digitalein.
  Digitaligenin.
  Digitalin.
  Digitonin.
  Digitoxigenin.
  Digitoxin.
  Gluconasturtiin.
  Glucotropæolin.
  Hederin.
  Helicin.
  Hesperidin.
  Kolanin.
  α-Methylglucoside.
  Myrticolorin.
  β-Naphthylglucoside.
  Ouabain.
  Osyritrin.
  Phloridzin.
  Plumieride.
  Plumieridic acid.
  Quercitrin.
  Rutin.

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Strophanthin.
o- and *p*-Tolylglucoside.
Vicin.
Violaquercitrin.
Xanthorhamnin.
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Jaundice, experimental, influence of, on the metabolism of sugar (von Reusz), A., ii, 168.
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  Acenaphthenequinone.
  Acetamidohydroxynaphthaquinone.
  Acetamidonaphthaquinone.
  Acetone.
  Acetonebenzil.
  Acetophenone.
  Acetoxybenzylideneacetophenone.
  Acetoxymethylanthraquinone.
  4′-Acetoxy-α-naphthaflavone.
  Acetylacetone.
  Acetylanisoil.
  Acetylbenzylic cyanide.
  Acetylbutylbenzene.
  Acetyldimethyl*cyclo*hexanone.
  Acetyldiphenyl.
  Acetyldiphenylpyridone.
  Acetylethylbenzene.
  Acetylmesitylene.
  Acetylmethylethylheptenone.
  Acetylmethylheptenone.
  Acetylphenetoil.
  Acetylphenylmethane.
  Acetyl*cyclo*propane.
  Acetyltoluene.
  Acetylxylene.
  Allylacetone.
  iso-Amylacetone.
  Anhydracetonebenzil.
  Anhydracetonedibenzil.
Ketones and **Quinones.** See:—
  Anilinoacetamidoquinone.
  Anilinobenzylbenzylideneacetone.
  Anilinohydroxyquinone.
  Anilinophenylketotetrahydroquinazoline.
  Anilinoquinone.
  p-Anisylidenecoumaranone.
  Anisylidene-4-ethoxy-2-hydroxyacetophenone.
  Anisylidene-2-hydroxyacetophenone.
  Anisylidenepaeonol.
  Anisyl methyl ketone.
  Anthraphenone.
  Azelaone.
  Benzil.
  Benzoin.
  Benzophenone.
  Benzoylacetone.
  Benzoylacetophenetidine.
  Benzoylfurfuran.
  Benzoylmesitylene.
  Benzoylmethylmorpholquinone.
  Benzoylpropionanilide.
  β-Benzoylpropionic anhydride.
  Benzoyltriethylbenzene.
  Benzoylxylene.
  Benzylideneacetone.
  Benzylideneanhydracetonebenzil.
  Benzylidenediacetylacetone.
  Benzylidenedibenzyl ketone.
  Benzylidenediphenyl*cyclo*pentenone.
  Benzylidenepaeonol.
  Benzylidenephenylacetone.
  Benzylidenequinone.
  Benzylidenetriphenylacetone.
  Benzylphenylacetone.
  Bismethylheptenone.
  iso-Butylideneacetone.
  Butyryl-*p*-cymene.
  Camphenilone.
  Camphoquinone.
  Camphorone.
  Carvenone.
  Chloralacetone.
  Cinnamylideneanhydracetonebenzil.
  Cresolphenolquinone.
  Cresolquinone.
  Cumylideneanhydracetonebenzil.
  Cymeneacetophenone.
  Cymophenone.
  Cymyl methyl ketone.
  Deoxybenzoin.
  Deoxytoluoin.
  r- and *l*-Desmotroposantonin.
  Desylenebenzylideneacetone.
  3 : 2′-Diacetoxyflavone.
  Diacetoxynaphthaquinone.
  Diacetylacetone.
  Diacetylmorpholquinone.
  Diacetylphenylmethane.
  Diacetylphloroglucinol.

Ketones and Quinones. See :—
Diacetyltriethylbenzene.
Dianilino*di*chloroquinone.
Dianilinonitroquinone.
Di-*o*-anisyldihydrazoneacetylacetone.
Dibenzoylanthracene.
Dibenzoyldiphenylbutadiene.
Dibenzoyldiphenylbutane.
Dibenzoyldiphenylbutene.
Dibenzoyldiphenylpropane.
Dibenzoylmesitylene.
αγ-Dibenzoylpropane.
Dibenzyl ketone.
Dibutylquinone.
Dicarvelone.
Diethoxyacetophenone.
Diethoxybenzylidenecoumaranone.
o-Diethoxydiphenyltetrahydropyrone.
Diethoxyflavone.
Diethoxyphenyl styryl ketone.
Diethylindolinone.
Diethyl ketone.
Di-eucarvone.
Di-α-furfuryloctanedione.
Digitoflavone.
Dihydrocamphorone.
Dihydroxyacetone.
Dihydroxy-ββ′-dipyridyldi-*p*-quinone.
Dihydroxyflavone.
Dihydroxynaphthaquinone.
Dihydroxyquinone.
Dihydroxyxanthone.
Diketobenzobisdihydropyrazole.
Diketodimethyldihexahydrophenyl.
Diketonaphthadihydropyrazole.
Diketonaphthafurazan.
Diketophenoheptamethylene.
Diketotetramethyldihexahydrophenyl.
Dimethoxybenzylidenecoumaranone.
Dimethoxyethoxybenzylidenecoumaranone.
Dimethoxypiperonalcoumaranone.
Dimethylacetone.
Dimethylacetophenone.
Dimethylacetylacetone.
Dimethylaminohydroxybenzophenone.
Dimethylbenzophenone.
Dimethyl diketone.
Dimethyl*cyclo*hexanedione.
Dimethyl*cyclo*hexanone.
1 : 3-Dimethyl-5-*cyclo*hexenone.
Dimethylindolinone.
αα-Dimethylketohexamethylene.
Dimethylketopyrrolidone.
Dimethylnaphthaquinone.
3 : 3-Dimethylpyrrolidone.
Dinaphthaquinone.
Dipentamethenylpinacolin.
Diphenacyldihydrophenanthrene.
Diphenylanthrone.

Ketones and Quinones. See :—
1 : 1-Diphenylbutene-1-one.
Diphenyldihydrazoneacetylacetone.
Diphthalidedimethyl ketone.
Dipropyl ketone.
Ditolylanthrone.
Di-*o*-tolyldihydrazoneacetylacetone.
Ditolyl-3-methylanthrone.
Ethoxybenzimidazolone.
4-Ethoxybenzylidene-2-acetophenone.
Ethoxydiphenylanthranone.
Ethoxyflavanone.
Ethoxyflavone.
Ethoxyhydroxyacetophenone.
Ethoxymethoxyflavone.
2-Ethoxy-α-naphthaflavone.
Ethoxyphenyldimethoxypyrrolidone.
p-Ethoxyphenyl methyl ketone.
Ethoxypiperonalcoumaranone.
Ethoxyquinone.
Ethyl amyl ketone.
Ethyl *iso*amyl ketone.
Ethyl butyl diketone (*propionylvaleryl*).
Ethyl butyl ketone.
Ethyl heptadecyl ketone.
Ethyl *iso*hexyl ketone.
Ethylideneacetone.
Ethyl pentadecyl ketone.
Ethylphthalazone.
Ethyl propyl diketone (*propionylbutyryl*).
Ethyl propyl ketone.
Fenchocamphorone.
Fenchone.
α-Furfurylbutanone.
Furfurylideneacetone.
Furfurylideneacetophenone.
Furfurylmethyl*cyclo*hexenone.
Geranylidene-acetone.
cyclo-Hexanone.
Hydracetylacetone.
β-Hydrindone.
Hydroxyacetophenone.
Hydroxycarone.
Hydroxychalkone.
Hydroxydiethoxychalkone.
Hydroxydimethoxychalkone.
Hydroxydimethoxyethoxychalkone.
Hydroxydimethoxymethylenedioxychalkone.
Hydroxydiphenyleneketone.
Hydroxyflavone.
Hydroxymethoxydiethoxychalkone.
Hydroxymethylanthraquinone.
4′-Hydroxy-α-naphthaflavone.
Hydroxynaphthaquinone.
Hydroxyphenacylphenanthrone.
Hydroxyphenoxyacetone.
Hydroxyphenyl*apo*saffranonequinone.
Hydroxyphenylmethylpyrimidone.
Hydroxyphenylphthalazone.

Ketones and **Quinones**. See :—
Hydroxypropylacetone.
ψ-Ionone.
Ketocoumaran.
α-Ketotetrahydronaphthalene.
allo-Lemonylidene-acetone.
Menthone.
Mesitoylmesitylene.
Mesityl methyl ketone.
Mesityl oxide.
Methoxydiethoxybenzylidenecoumaranone.
Methoxydiethoxychalkone.
Methoxydiphenylanthranone.
Methoxyethoxyflavanone.
Methoxyethoxyflavone.
4′-Methoxy-α-naphthaflavone.
Methoxyphenyldimethylpyrrolidine.
Methoxyphenylketodihydroquinazoline.
Methoxyphenylmethyl*cyclo*hexenone.
Methoxyphenylmethylpyrimidone.
3-Methoxypiperonalcoumarone.
Methylacetylacetone.
β-Methylæsculetin.
Methyl amyl diketone (*acetylhexoyl*).
Methyl *iso*amyl diketone (*acetyliso-hexoyl*).
Methylbenzophenone.
Methyl*tert*butylacetophenone.
Methyl butyl diketone (*acetylvaleryl*).
Methyl butyl ketone.
Methylcinnamylideneacetone.
Methylcinnamylideneacetophenone.
Methyldeoxybenzoin.
Methyl ethyl ketone.
Methylethylphthalazone.
Methylheptenone.
2 : 3 : 5-Methylhexenone.
Methyl*cyclo*hexenone.
Methyl *iso*hexyl diketone.
Methyl hexyl ketone.
Methyl hydroxyethyl ketone.
Methylnonenone.
Methyl nonyl ketone.
Methyl*cyclo*pentanone.
Methyl*iso*propyl*cyclo*hexanone.
Methyl *n*- and *iso*-propyl ketones.
Methyltriphenyl*cyclo*hexenone.
Morpholquinone.
α-Naphthaquinone.
Naphthaquinoneaminoguanidine.
Naphthaquinonediphenylmethane.
Naphthaquinonetetramethyl*di*aminodiphenylmethane.
1 : 1′-Naphthoylhydrazimethylene.
Naphthoylmethylene*iso*benzalazine.
Pentahydroxybenzophenone (*maclurin*).
Phenacylphenanthrone.
Phenanthraquinone.
p-Phenetylpyridazinone.

Ketones and **Quinones**. See :—
Phenoketoheptamethylene.
Phenolthymoquinone.
Phenoltoluquinone.
Phenylacetoacetic acid.
Phenyl anilinomethyl ketone.
Phenylbenzoin.
Phenylbenzylideneglyoxalidone.
Phenylbenzylidenepyridazone.
Phenylcamphopyrazolone.
Phenyldimethylketopyrrolidone.
Phenyldimethylpyridone.
Phenylmethylcamphopyrazolone.
Phenylmethyldiketotetrahydroquinazoline.
Phenylmethyl*cyclo*hexanone.
Phenylmethyl*cyclo*hexenones.
Phenylmethylimidazolonenaphthaquinone.
Phenylmethylketodihydroquinazoline.
Phenyl methyl ketone.
Phenylmethylketotetrahydroquinazoline.
Phenylmethylthioketodihydroquinazoline.
Phenyl pentadecyl ketone.
Phenyl phthalidemethyl ketone.
Phenylpyridazone.
Phenyltetrahydro-β-naphthenone.
Phenyltolylanthrone.
Phenyltolylmethylanthrone.
Phenyl tolyl ketone.
Phenyltolylketosulphone.
Phloracetophenone.
Phorone.
Phthalide dimethyl ketone.
Pinacolin.
Pinacone.
Pinolone.
Piperil.
Piperonalcoumaranone.
Piperonal-2′-hydroxyacetophenone.
Piperonalpaeonol.
Piperonylmethyl*cyclo*hexenone.
Propionylanisoil.
Propionyl-ψ-cumene.
Propionylethylbenzene.
Propionylpentethylbenzene.
iso-Propylimidazolone.
iso-Propylphenylmethyl*cyclo*hexanone.
iso-Propylphenylmethyl*cyclo*hexenone.
Pulegenacetone.
Pulegone.
Quinone.
Quinoneaminoguanidine.
Quinonebisdiphenylmethane.
Quinonebistetramethyl*di*aminodiphenylmethane.
Santonin.
Δ^4-Terpeneone.
Tetrahydro-β-oxazole diketones.
Tetrahydroxybenzophenone.

Ketones and Quinones See :—
  Tetraketohydronaphthalene.
  Thymolphenolquinone.
  Thylmoquinone.
  Toluquinone.
  Tolyl anilinomethyl ketone.
  Tolyl ethyl ketone.
  p-Tolylideneacetone.
  p-Tolylideneacetophenone.
  Tolyl methyl ketone.
  Triacetylpentaphenylpentane.
  Triethylbenzophenone.
  Trihydroxybenzophenone (*alizarin yellow A.*).
  Triketomethyl*cyclo*hexene.
  Trimethoxyanthraquinone.
  Trimethoxybenzoylacetophenone.
  Trimethoxydihydroanthrone.
  Trimethylbenzimidazolone.
  Trimethyldeoxybenzoin.
  Triphenyloxazolone.
  Tuberone.
  Xyloquinone.
  Xylyl methyl ketone.
  Xylylquinazolone.
  Xylyltetrahydroketoquinazoline.
Ketonic bases (Schmidt), A., i, 4.
Ketoterpin, and sodium derivative, oxime, semicarbazone, phenylhydrazone (von Baeyer and Baumgärtel), A., i, 224.
a-**Ketotetrahydronaphthalene**, conversion of oxime, into tetrahydro-*a*-naphthylamine (Kipping and Hill), T., 152 ; P., **1899**, 5.
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Ketovalerolactonecarboxylic acid, from action of sulphuric acid on barium parapyruvate, and the action of alkalis on it (Wolff), A., i, 483.
Kickxia Africana, caoutchouc from (Lindet), A., ii, 508.
Kidney, influence of the, on metabolism (Bradford), A., ii, 310.
Kinetic theory of liquids (Jäger), A., ii, 404.
Kola, estimation of caffeine in (Gadamer), A., ii, 390.
Kola nuts, constituents and derivatives of (Schweitzer), A., i, 300.
Kolanin, preparation of caffeine and theobromine from, and its composition (Schweitzer), A., i, 301.
Kosin and its oxidation, triacetyl, and tribenzoyl derivatives (Daccomo and Malagnini), A., i, 158.
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Krypton, discovery of (Ramsay), A., ii, 212.
Krypton, position of, in the scheme of elements (Crookes), A., ii, 552 ; (Howe), A., ii, 740.
Kyanite from Scotland (Heddle), A., ii, 497.
Kyanite-schist from Brazil (Derby), A., ii, 501.
Kyschtymite from the Urals (Morozewicz), A., ii, 763.
Kynurenic acid, origin of, in the organism (Mendel and Jackson), A., ii, 117.

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Lac, stick- and bleached, constituents of (Tschirch and Farner), A., i, 446.
Laccase (Bertrand), A., i, 313 ; (Roux), A., ii, 444.
Lacmoid as an indicator (Waddell), A., ii, 83 ; (Glaser), A., ii, 573.
Lactase, presence of, in the small intestine (Weinland), A., ii, 604.
  isolation of, from lactose-fermenting yeasts (Dienert), A., ii, 442.
Lactic acid (i-*ethylidenelactic acid*, *a-hydroxypropionic acid*), manufacture and purification of (Claflin), A., i, 12.
  electrical dispersion of (Löwe), A., ii, 201.
  estimation of (Ulsch), A., ii, 802.
Lactic acid, alkali salts, action of molybdic oxide on (Henderson, Orr, and Whitehead), T., 553 ; P., **1899**, 108.
  ethereal salts, densities, specific rotations, and molecular volumes of (Frankland), T., 357.
  ethylic salt, chlorocarbonate, carbamate and nitrocarbamate of (Thiele and Dent), A., i, 16.
  phenylurethane, sodium, and ethylic salts of, and *tri*chloro- (Lambling), A., i, 52.
Lactic acid, *tri*chloro-, velocity of crystallisation of (Bogojawlensky). A., ii, 206.
d-**Lactic acid**, methylic and ethylic salts, preparation and specific rotation of (Purdie and Irvine), T., 484 ; P., **1899**, 74.
Lactone, $C_{12}H_{10}O_7$, obtained in condensation of ethylic acetonedicarboxylate (Jerdan), T., 810.
  $C_{15}H_{14}O_2$, from benzaldehyde and pyrocinchonic anhydride (Thiele), A., i, 216.
  $C_{15}H_{16}O_6$, from oxidation of trimethylbrazilin (Gilbody and Perkin), P., **1899**, 28.

Lactone, $C_{16}H_{12}O_2$, from desylacetic acid and acetic anhydride (THIELE), A., i, 217.
$C_{17}H_{12}O_2$, from benzaldehyde and phthalic anhydride (THIELE), A., i, 216.
$C_{17}H_{12}O_2$, from dibenzylidenepropionic acid and bromine (THIELE), A., i, 217.
$C_{17}H_{14}O_2$, from phenacylhydrocinnamic acid and acetic anhydride (THIELE), A., i, 217.
$C_{20}H_{12}O_6$, from condensation of oxalic acid and resorcinol, its triacetyl and *di*nitro-derivatives (HEWITT and PITT), T., 522; P., **1899**, 100.
$C_{20}H_{14}O_6$, tetracetyl derivative, from condensation of oxalic acid and resorcinol (HEWITT and PITT), T., 523; P., **1899**, 101.
Lactones, picrates of, cryoscopic behaviour of (BRUNI and CARPENÈ), A., ii, 8.
Lactones. See also:—
Acetoxyhydroxydimethylglutaric lactone.
2-Acetylangelicalactone, α- and β-.
Acid-cellulose lactone.
d- and *r*-Arabonic lactones.
Benzoxyhydroxydimethylglutaric lactone.
iso-Butylparaconic lactone.
Butyrolactone.
ψ-Campholactone.
Campholide.
Cannabinolactone.
Cantharidin.
iso-Cantharidin.
iso-Caprolactone (*hydroxyhexolactone*).
Cinnamylidenedimethylcrotonolactone.
Cinnamylidenedimethylcrotonolactonecarboxylic acid.
Cornicularolactone.
Coumarin.
α′β-Dihydroxy-αα-diethylglutaric lactone.
Dihydroxydimethylacetoacetic lactone.
α′β-Dihydroxy-αα-dimethylglutaric lactone.
βγ-Dihydroxy-αα-methylethylglutaric lactone.
Dihydroxynonoic γ-lactone
Diphenylbutyrolactoneacetic acid.
Diphenylcrotonolactone.
Diphenylcrotonolactoneacetic acid.
Diphenylcrotonolactonecarboxylic acid.
αδ-Diphenyl-αγ-pentanolide.
Ethylparaconic acid.
iso-Heptodilactone.
Hexylparaconic acid.
Lactones See:—
Hydroxycamphoceanolactone.
γ-Hydroxydiethylacetoacetic lactone.
γ-Hydroxydimethylacetoacetic lactone.
Hydroxydimethylglutaric lactones.
Hydroxydiphenylacetamidoacetolactone.
Hydroxydiphenylbutyrolactoneacetic lactone.
Hydroxyhexoic lactone.
Hydroxyphenoxyacetic lactone.
Hydroxyphenylbenzylbutyrolactoneacetic acid.
Hydroxyphenylbutyrolactoneacetic lactone.
Hydroxyterpenylic dilactone.
Ketolactone, $C_{10}H_{16}O_3$.
1:3-Methylmorpolone.
iso-Nonodilactone.
Oxycannabin.
Phenylbenzylbutyrolactoneacetic acid.
Phenylbenzylcrotonolactone.
Phenylbenzylcrotonolactoneacetic acid.
Phenylbenzylidenebutyrolactone.
Phenylbenzylidenecrotonolactone.
γ-Phenyl-β-benzylidene-α-ketobutyrolactone.
Phenylbenzylidenemethylcrotonolactone.
Phenylbromobenzyl-α-crotonolactone.
Phenylbromobenzylidenecrotonolactone.
Phenylbutyrolactoneacetic acid.
Phenyl-*p*-cresylacetamidoacetolactone.
Phenyl-*m*-cresylbromacetolactone.
Phenyl-*p*-cresylbromacetolactone.
Phenylcresylethoxyacetolactone.
Phenylhydroxynaphthylbenzyloxyacetolactone.
Phenyl-β-hydroxynaphthylbromacetolactone.
Phenylhydroxynaphthylethoxyacetolactone.
Phenylhydroxynaphthylmethoxyacetolactone.
Phenylorcylacetolactone.
Phenylresorcylacetolactone.
Phenylxylylketoximecarboxylic oximidolactone.
Propylparaconic and *iso*-Propylparaconic acids.
iso-Propyl*iso*paraconic acid.
iso-Saccharin.
iso-Terebic acid.
Undecodilactone.
Lactonic acid, $C_{10}H_{16}O_4$, from hydroxymethyl*iso*propyladipic acid (TIEMANN and SEMMLER), A., i, 225.
Lactonitrile. See α-Hydroxypropionitrile.

Lactose (*milk sugar*), action of alkalis on (de Bruyn and Alberda van Ekenstein), A., i, 661.
  action of yeast enzymes on (Kalanthar), A., i, 102.
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  estimation of sucrose in presence of (Dowzard), T., 371 ; P., **1899**, 9.
Lævulic acid (*β-acetylpropionic acid*), synthesis of ; also its semicarbazone (Blase), A., i, 793.
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Lævulose (*fructose*), action of methyl-alcoholic ammonia on (de Bruyn), A., i, 732.
  oxidation of, by hydrogen peroxide (Morrell and Crofts), T., 789 ; P., **1899**, 99.
  action of yeast-extract and Munich bottom-yeast on (Buchner and Rapp), A., ii, 606.
  fate of, after injection into the circulation (Pavy), A., ii, 677.
  detection of (Gawalowski), A., ii, 255.
  estimation of, as osazones (Lintner and Krober), A., ii, 66.
  estimation of, in brewing sugars (Morris), A. ii, 187.
Lagoriolite, artificial (Morozewicz), A., ii, 764.
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  Cocoa nut oil.
  Cognac oil.
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  Cotton-seed oil.
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  Jaborandi leaf oil.
  Jasmine, oil of.
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  Lemon-grass, oil of.
  Lepidium sativum, oils from.
  Linseed oil.
  Lippia citriodora, oil from.
  Maize oil.
  Mandarins, oil of.
  Matico oils.
  Melissa, oil of.
  Monarda fistulosa, oil from.
  Monarda punctata, oil from.
  Mustard oil.
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  Neroli oil.
  Olive oil.
  Origanum Majorana, oil from.
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  Picea nigra L. (or *alba* ?), oil from.
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  Mercurio-acetonaphthalide.
  Mercuriodiphenylamine.
  p-Mercuriodiphenylenediphenyldimethylmercuriodiammonium hydroxide.
  Mercuriodiphenylenediphenylmercuriodiammonium hydroxide.
  Mercuriomethacetin.
  Mercurocarbide nitrate.
  Mercury acetylide.
  Mercurydimethyl.
  Mercurydiphenetyl.
  Mercurydiphenyl.
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  Phenylenedimercuric salts.
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  Phenylstibine.
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Acetoxime.
Acetylcamphoroxime.
Acetyldimethylheptoic oxime.
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βα-Acetyl*iso*heptylphenylhydrazoxime.
Acetyl*iso*hexyldioxime.
βα-Acetyl*iso*hexylphenylhydrazoxime.
Acetylmethylheptenoneoxime.
Acetylpalmityldioxime.

Oximes. See :—
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  Acetylquinoneoxime.
  Acetylstearyldioxime.
  Acid, $C_{10}H_{18}O_3$, oxime of.
  Aldoximephenoxyacetic acid.
  Anilinobenzylacetoacetic acid oxime.
  Benzenylanilidoxime.
  Benzenylazoxime.
  Benzenylpiperidoxime.
  Benzenyltoluidoxime.
  Benzhydroximic acid.
  Benzildioximes.
  Benzoylacetonoxime.
  Benzoylfurfuranoxime.
  Benzyl α-ethyl benzyl ketoxime.
  Benzylmethylketoxime-*o*-carboxylic acid.
  Benzyloxybenzaldoxime.
  Benzylphenylacetoxime.
  Benzylsalicylaldoxime.
  iso-Butylideneacetoxime.
  iso-Campheniloneoxime.
  Camphoroxime.
  Carbonic acid, imino-, dioxime of.
  Carvyldioxime.
  Dibenzenylazoxime.
  Dibenzoyldiphenylbutadienedioxime.
  Dibenzoyldiphenylbutenedioxime.
  Dibenzoylpropanedioxime.
  Dibenzyl ketoxime.
  Dicampherylic acid oxime.
  Diethoxydiphenyltetrahydropyroneoxime.
  Diethylindolenineformamidoxime.
  Diethylindolenineformoxime.
  β-Digitogenic acid, oxime of.
  Digitoseoxime.
  Dihydroxydipyridyldiquinonedioxime.
  Diketophenoheptamethylenedioxime.
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  Dimethylallylmalonic acid, ethylic salt, oxime of.
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  Dimethyl*cyclo*hexanoneoxime.
  Dimethylindazoneoxime.
  Dimethylindolenineformoxime.
  αα-Dimethylketohexamethyleneoxime.
  Dimethylsalicylaldoxime.
  Dipentamethenylpinacolinoxime.
  Diphenylacetylacrylic oxime.
  Diphenylbuteneoneoxime.
  Diphenylcarbamideoxime.
  Diphenyltetrahydropyroneoxime.
  Diphthalidedimethylketoxime.
  Ethaneprotocatechuic aldoxime.
  Ethyl butyl diketoxime.
  Ethyl heptadecyl ketoxime.
  Ethyl propyl diketoxime.
  Furfurylmethyl*cyclo*hexenoneoxime.
  cyclo-Hexanoneoxime.

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  m-Hydroxybenzaldoxime.
  Hydroxycaroneoxime.
  γ-Hydroxydimethylacetoacetic acid, oximido-lactone of.
  Hydroxymethylbenzophenoneoxime.
  Hydroxyphenoxyacetoxime.
  Ketoterpinoxime.
  Ketotetrahydronaphthaleneoxime.
  Malonic aldehyde aniloxime.
  Malonic dialdoxime.
  Mesityloximes.
  Methoximidoxazoloneoxime.
  Methoxyphenyl*cyclo*hexenoneoxime.
  Methoxyphenylmethyl*cyclo*hexenoneoxime.
  Methyl amyl diketone, phenylhydrazoxime of.
  Methyl *iso*amyl diketoxime.
  Methyl butyl diketoxime.
  Methylcinnamylideneacetoneoxime.
  Methylcinnamylideneacetophenoneoxime.
  Methyl ethyl glyoxime.
  Methylglyoximecarboxylic acid.
  Methylgranatonineoxime.
  Methylindoleoxime.
  Methyl nonyl ketoxime.
  Methyl*cyclo*pentanoneoxime.
  Methyl*iso*propyl*cyclo*hexanoneoxime.
  Methylpropylketoxime.
  Methyltriphenyl*cyclo*hexenoneoxime.
  Oximidomethylisoxazoloneoxime.
  Phenylbenzaldehydeoxime.
  Phenyldimethylketopyrrolidineoxime.
  Phenylindole, *iso*nitroso-.
  Phenylmethyl*cyclo*hexanoneoxime.
  Phenylmethyl*cyclo*hexenoneoxime.
  Phenyl methyl ketoxime.
  Phenyloximido-oxazolone.
  Phenyl phthalidemethyl ketoxime.
  Phenylpyrazolone, *iso*nitroso-.
  Phenyl-*o*-xylylketoximecarboxylic acid.
  Phoronediacetic acid, oxime of.
  Phthalidedimethyl ketoximes.
  Pinacolinoxime.
  Piperidylacetoxime.
  Piperiloxime.
  Piperonylidenediacetoacetic acid, oxime of.
  Piperonylmethyl*cyclo*hexenoneoxime.
  Propionylethylbenzeneoxime.
  Propionylhydroxypropionic acid, oxime of.
  iso-Propylphenylmethyl*cyclo*hexenoneoxime.
  iso-Propylphenylmethyl*cyclo*hexenonedicarboxylic acid, oxime of.
  Pulegenacetoneoxime.
  Pyridylacetonylchloride, oxime of.

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- Pyrroline, *iso*nitroso-.
- Quinonedioxime.
- Quinoneoxime.
- Quinoneoximesemicarbazone.
- Santonic acid, oximes of.
- Santonin-oxime.
- Tetraketohydronaphthaleneoxime.
- Toluenedioximes.
- Toluquinoneoxime.
- *p*-Toluylideneacetophenoneoxime.
- Tolylacetodinitrileoxime.
- Triacetonylaminetrioxime.
- Triazendicarbamidine amidoxime.
- Trimethylacetonylammonium chloride, oxime of.
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  Albumoses.
  Anti-albumid.
  Antipeptone.
  Arbacin.
  Artolin.
  Casein.
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  Deuteroalbumoses.
  Edestin.
  Fibrin.
  Fibroin.

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  Gelatin, silk-.
  Globin.
  Globulin, egg-.
  Glucoproteid from ox blood.
  Gluten, wheat-.
  Glutolin.
  Hæmoglobin.
  Hemipeptone.
  Histon.
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  Glucose (*dextrose*).
  Hederose.
  Hexose.
  Invert-sugar.
  Lactose.
  Lævulose.
  Maltose.
  Mannose.
  Melibiose.
  Melicitose.
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  Benzylidenenaphthylsulphonehydrazide.
  Dibenzenesulphonehydrazide.
  Dimethoxydiphenyldisulphonehydroxylamine.
  Di-naphthylsulphonehydrazide.
  Diphenylenedisulphone.
  iso-Diphenylenedisulphone.
  Diphenylsulphone.
  Diphthalimidosulphonal.
  Ditolyldisulphone.
  Ditolylenedisulphone.
  Ethylacetonetriethyltrisulphone.
  Methoxyaminopropanetriethyltrisulphone.
  Naphthylpropylsulphone.
  Naphthyl*iso*propylsulphone.
  β-Naphthylsulphonazide.
  Naphthylsulphonebutyric acids.
  Naphthylsulphonehydrazide.
  Phenylpropylsulphone.
  Phenyl*iso*propylsulphone.
  Phenylsulphonebutyric acid.
  Phenylsulphone*iso*butyric acid.
  Phenylsulphonesodioacetic acid.
  Phenyltolyldisulphone.
  Phenyltolylketosulphone.
  Phthalimidosulphonal.
  Propylidenebenzenesulphonehydrazide.
  Propylidenenaphthylsulphonehydrazide.
  Sulphonal.
  Sulphonalphthalamic acid.
  Toluenesulphonacetic acid.
  Toluenesulphonacetoacetic acid.
  Toluenesulphonomalonic acid.
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(*Toluene compounds Me*=1).

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(*Toluene compounds Me*=1).

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p-**Toluenesulphonacetic acid** and *p*-**Toluenesulphonacetoacetic acid,** ethylic salts (KOHLER and MACDONALD), A., i, 907.

o-**Toluenesulphonic** sulphide, *tri*sulphide, and *tetra*sulphide (TROEGER and HORNUNG), A., i, 905.

p-**Toluenesulphonic** chloride and diethylamide (MARCKWALD and DROSTE-HUELSHOFF), A., i, 290.
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p-**Toluenesulphonomalonic acid** and *p*-**Toluenesulphonosodiomalonic acid,** ethylic salts (KOHLER and MACDONALD), A., i, 907.

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o-**Toluic acid,** cyano-, substance obtained from, on heating (MATHEWS), A., i, 57.
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p-**Toluic acid,** formation of (COLLET), A., i, 434.
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o- and *m*-**Toluic acids,** menthol salts of, optical activity and molecular volume of (TSCHUGÁEFF), A., ii, 3.

o- and *m*-**Toluic** chlorides (KLAGES and LICKROTH), A., i, 599.

(*Toluene compounds Me*=1).

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o-**Toluidine**, compounds of, with metallic salts (Matthews), A., ii, 296.
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m-**Toluidine**, *ω-tri*fluoro-, and its acetyl derivative (Swarts), A., i, 197.

p-**Toluidine**, formation of (Löb), A., i, 123.
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p-**Toluidine**, *m*-nitro-, electrolytic reduction of (Elbs and Schwarz), A., i, 270.

o- and *p*-**Toluidine**, hydrochlorides of, action of chromic acid on (Oechsner de Coninck and Combe), A., i, 244.

o-, *m*-, and *p*-**Toluidine** mercurichlorides (Swan), A., i, 38, 39.
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p-**Toluidine-*o*- and *m*-sulphonic acids** (Cazeneuve and Moreau), A., i, 431.

p-**Toluidinoacetic acid**, nitrile and amide and nitroso-derivative of the last (Miller, Plöchl, and Sieber), A., i, 128.

p-**Toluidino-oxalic acid**, amino-, methylic salt (Anschütz and Stiepel), A., i, 573.

o-**Toluonitrile**, *p*-nitro-, and *p*-amino- and its salts (Landsberger), A., i, 210.

m-**Toluonitrile**, *ω-tri*fluoro- (Swarts), A., i, 197.

o-, *m*-, and *p*-**Toluonitriles**, action of cuprous chloride on (Rabaut), A., i, 557.

(*Tolyl compounds Me*=1).

p-**Toluoylcarbinyl acetate** (Collet), A., i, 434.

Toluoylmalic acids, *o*-, *m*-, and *p*-, methylic and ethylic salts, preparation and specific rotations of (Frankland and Wharton), T., 341; P., **1899**, 26.
  methylic and ethylic salts, molecular volumes of (Frankland), T., 349.

p-**Toluoylmethylcarbinyl** acetate (Collet), A., i, 434.

Toluoyltartaric acids, *o*-, *m*-, and *p*-, ethylic salts, molecular volumes of (Frankland), T., 349.

Toluquinone, 4-bromo-, [$O_2 : Br = 2 : 5 : 4$] (Kehrmann and Rüst), A, i, 129.

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o-**Tolylacetic acid**, condensation of, with phthalic anhydride (Bethmann), A., i, 520.

p-**Tolylacetodinitrile** oxime (Seidel), A., i, 139.

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p-**Tolylacrylic acid** (p-*methylcinnamic acid*), *m*-nitro-, and salts (Hanzlik and Bianchi), A., i, 891.

o-**Tolylaminoacetic acid**, and *di*chloroderivative (Hentschel), A., i, 815.

p-**Tolyl anilinomethyl ketone** (Collet), A., i, 55.

p-**Tolyl-ψ-aziminoaminobenzene**, and its salts and acetyl derivative (Willgerodt and Dauner), A., i, 825.

p-**Tolyl-ψ-aziminobenzene** (Willgerodt and Klein), A., i, 882.

p-**Tolyl-ψ-aziminonitrobenzene** (Willgerodt and Dauner), A., i, 824.
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4-*p*-**Tolylbenzaldehyde** (Weiler), A., i, 519.

p-**Tolylbromopropylsulphone** (Troeger and Uhde), A., i, 608.

o-**Tolylcarbamic acid**, 5-nitro- and 4-nitro- (Vittenet), A., i, 757.

(*Tolyl compounds Me*=1).

p-**Tolylcarbamic acid**, *m*-nitro-, and *o*-nitro-, ethylic salts (Vittenet), A., i, 757.

o-, *m*-, and *p*-**Tolylcarbamides**, and nitroso-derivatives (Walther and Wlodkowski), A., i, 590, 591.

o-**Tolylcarbimide**, 5-nitro- and 4-nitro- (Vittenet), A., i, 757.

p-**Tolylcarbimide**, *m*-nitro-, and *o*-nitro- (Vittenet), A., i, 757.

p-**Tolyl chloromethyl ketone** (Collet), A., i, 55.

4-Tolyl-4-chlorophenylthiosemicarbazide, the imidodiazolone and thiodiazolone (Marckwald), A., i, 504.

Tolyl-4-chlorophosphine, 2-chloro- (Melchiker), A., i, 207.

p-**Tolylchlorostibine** (Hasenbäumer), A., i, 209.

2-Tolyl*iso*coumarin (Bethmann), A., i, 520.

2-Tolyldihydro*iso*coumarin, and bromo-derivative (Bethmann), A., i, 520.

p-**Tolyldithiocarbazinic acid**, methylic and ethylic, and benzylic salts (Busch and Lingenbrink), A., i, 953.

p-**Tolyl*iso*dithiodiazolone**, and its methiodide (Busch and Lingenbrink), A., i, 954.

p-**Tolyldithiodiazolone-sulphonic acid**, **-hydrosulphamine**, **-dimethylhydrosulphamine**, and **ethylhydrosulphamine** (Busch and von Baur-Breitenfeld), A., i, 951.

o-**Tolyldithiodiazolonethiol**, and its methylic ether, *di*sulphide, and *p*-aminophenylic ether (Busch and Münker), A., i, 952.

p-**Tolyldithiodiazolonethiol**, and its methylic ether, *di*sulphide, and acetyl and benzoyl derivatives, and *p*-aminophenylic, and methylaminophenylic ethers, with their nitrosamine derivatives and azo-dye (Busch and von Baur-Breitenfeld), A., i, 951.

m-**Tolylenediamine**, action of, on red blood corpuscles (Lapicque and Vast), A., ii, 504.

Tolylenedimethylcarbamide. See 2:1′:3′-Trimethylbenzimidazolone.

Tolylenedimethyldiamine [$NMe_2:NH_2=2:4$] (Gnehm and Blumer), A., i, 266.

1:2:3-Tolylenefurazan, **1.3:4-tolylenefurazan** (Zincke and Schwarz), A., i, 751.

Tolylenemethyl-blue hydrochloride (Gnehm and Blumer), A., i, 266.

Tolylenemethyldiamine [$NHMe:NH_2=2:4$], and sulphate (Gnehm and Blumer), A., i, 266.

(*Tolyl compounds Me*=1).

p-**Tolylethylideneoxy*cyclo*triazan** (Voswinckel), A., i, 959.

2-Tolylethylthiosemicarbazide (Marckwald), A., i, 505.

o- and *p*-**Tolylglucoside** (Ryan), T., 1056; P., **1899**, 196.

o- and *p*-**Tolylglycinyl-carbamides**, **-*p*-ethoxyphenylcarbamides**, **-ethylurethanes**, and **-phenylcarbamides** (Frerichs and Beckurts), A., i, 806.

p-**Tolylglyoxylic acid** (Verley), A., i, 207.

p-**Tolylhydrazine**, *m*-nitro-, hydrochloride (Zincke and Schwarz), A., i, 751.

o-**Tolylhydroxylamine**, preparation of (Haber), A., i, 270.

Tolylhydroxynaphthazinedisulphonic acid, sodium salt (Hantower and Täuber), A., i, 63.

o-**Tolylic** carbamate, preparation of (Morel), A., i, 876.
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o- and *p*-**Tolylic** chlorocarbonates (Barral and Morel), A., i, 747, 802.
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  *tri*sulphides (Troeger and Hornung), A., i, 906.

o-, *m*-, and *p*-**Tolylic** ethylic carbonate (Morel), A., i, 875, 876.

p-**Tolylidene** diacetate, *m*-nitro- (Hanzlik and Bianchi), A., i, 891.

p-**Tolylideneacetone**, and *m*-nitro-, and phenylhydrazones and dibromides (Hanzlik and Bianchi), A., i, 890.

p-**Tolylideneacetophenone**, and *m*-nitro-, and their dibromides, oximes, and phenylhydrazones (Hanzlik and Bianchi), A., i, 890.

p-**Tolylidene-*m*- and -*p*-nitranilines**, and *m*-nitro-derivative of former (Hanzlik and Bianchi), A., i, 597.

p-**Tolylidene-*m*-nitro-*m*- and -*p*-xylidines** (Hanzlik and Bianchi), A., i, 597.

o-**Tolylimino-*o*-tolylcarbamic acid**, ethylic, propylic, *iso*butylic, and *iso*amylic salts (Dains), A., i, 592.

p-**Tolylimino-*p*-tolylcarbamic acid**, methylic, propylic and *iso*amylic salts (Dains), A., i, 592.

p-**Tolyl iodethyl** and **iodomethyl ketones** (Collet), A., i, 434.

Tolyl-3-methylanthranol (Guyot), A., i, 293.
  condensation of, with toluene (Guyot), A., i, 295.

p-**Tolylmethyl*iso*dithiodiazolone** (Busch and Lingenbrink), A., i, 954.

(*Tolyl compounds Me*=1).

p-**Tolyl methyl ketone**, preparation of; bromo-, and *di*bromo-derivatives (Verley), A., i, 207.

Tolylmethylnitramine, amino- (Pinnow and Oesterreich), A., i, 202.

o-**Tolylmethylnitrosamine**, 4-nitro- (Gnehm and Blumer), A., i, 265.

Tolyl-3-methyloxanthranol (Guyot), A., i, 294.

p-**Tolylmethyloxy*cyclo*methylenetriazan** (Voswinckel), A., i, 959.

1 : 2-*p*-Tolylmethylpyrrolidine (Scholtz and Friemehlt), A., i, 541.

p-**Tolylmethylthiodiazolinethiol**, and its *di*sulphide and methylic ether (Busch and Lingenbrink), A., i, 954.

o- and *p*-**Tolylmethylthiosemicarbazides** (Marckwald), A., i, 504, 505.

p-**Tolylnaphthindolinonequinonecarboxylic** toluidide (Liebermann), A., i, 523.

o- and *p*-**Tolyl-α-** and **-β-naphthylthiosemicarbazides** (Marckwald), A., i, 504, 505.

p-**Tolyl-*p*-nitro-*o*-tolyldisulphone** (Kohler and MacDonald), A., i, 905.

δ-*p*-Tolyloxybutylamine (Schlinck), A., i, 540.

γ-*p*-Tolyloxybutyric acid, and **nitrile** (Schlinck), A., i, 540.

p-**Tolylpentahydro-1 : 2 : 4-diazthine** (Busch and Lingenbrink), A., i, 953.

p-**Tolyl-*o*-phenylene-*p*-aminobenzenylamidine**, and nitro-derivative (Muttelet), A., i, 355.

p-**Tolyl-*o*-phenylenediamine**, methenyl derivative, mercurichloride (Jacobson and Lischke), A., i, 276.

4-Tolylphenylmethane (Weiler), A., i, 491.

Tolylphosphine *tetra*chloride, and oxychloride, 2-chloro- (Melchiker), A., i, 208.

Tolyl-4-phosphinic acid, 2-chloro-, 2-chloronitro-, and their salts (Melchiker), A., i, 208.

Tolylphosphinous acid, chloro-, its salts and phenylhydrazide (Melchiker), A., i, 208.

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Zymase in yeast extract, artificial increase of (ALBERT), A., ii, 783.

ERRATA.

VOL. LXX. (ABSTR., 1896).

PART I.

Page	Line	
446	8* and 3*	*for* “sobreritritol” *read* “sobrerythritol.”

VOL. LXXII. (ABSTR., 1897).

PART II.

37	18*	*for* “1895” *read* “1896.”

VOL. LXXIV. (ABSTR., 1898).

PART I.

Page	Line	
53	25	*for* “Dobie” *read* “Dobbie.”
700	4*	,, “α-uric” *read* “α-methyluric.”

PART II.

14	2* and 1*	*for* “C_5H_6·” *read* “C_6H_5·.”
277	5*	,, “$HNO_3,10H_2O$” *read* “$10HNO_3,H_2O$.”

INDEX.

Page	Col.	Line	
709	ii	35	for “*H. M.* **Goodwin**” read “*Harry Mann* **Gordin**.”
713	ii	5*	*should read* “**Salvadori,** *Roberto.* See *Raffaele* **Nasini**.”
718	i	10*	*for* “21” *read* “213.”
900	ii	13	,, “1889” *read* “1898.”
935	i	22	,, “*diphenylethylene*” read “*phenylethylene.*”

VOL. LXXVI. (ABSTR., 1899).

PART I.

Page	Line	
2	2	*for* “sodium” *read* “iodine.”
42	13, 14, and 19,	in formulæ, *for* “·$CHCl_3$·” *read* “·$CH(CCl_3)$·.”
48	bottom	,, ,, “·CO·NH” ,, “·CO·NH_2”
53	22*	*for* “RIZZO NICCOLÒ” *read* “NICCOLÒ RIZZO.”
98	20	,, “ethylene” *read* “ethane.”
108	16	,, “foregoing” *read* “following.”
124	3	,, “1-amido-” *read* “2-amido-.”
126	3*	,, “diphenylthiocarbamate” *read* “diphenylcarbamate.”
144	3	,, “$C_{22}H_{18}N_2O$” *read* “$C_{22}H_{18}N_2O_2$.”
185	8*	,, “37” *read* “371.”
197	12	,, “$CPhFCl_2$” *read* “$CPhF_2Cl$.”
203	11	,, “[Me : N_2 : NO_2,” etc., *read* “[Me_2 : N : NO_2,” etc.
256	top	,, “*dimethylacetonecyanhydrin*” read “*acetonecyanhydrin.*”
,,	25	*should read* “is converted into *monochlorisobutylacetonitrile* or *α-chlorocapronitrile.*”
,,	13*	for “*α-chlorocapronitrile*” read “*α-chlorocaprylonitrile.*”

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* From bottom.

Page	Line	
258	top	*for* “$CH_2{:}CH{\cdot}CH_2{\cdot}COCl$” *read* “$CH_2{:}CH{\cdot}CH_2{\cdot}CH_2{\cdot}COCl$.”
268	13*	,, “sulphuric” *read* “nitric.”
278	5	,, “*α-bromisobutyrylmetaxylidide*” read “*α-bromisovalerylmetaxylidide.*”
288	1	,, “*metamethoxyglyoxylic*” read “*metamethoxyphenylglyoxylic.*”
,,	21 and bottom	,, “$CO{\cdot}COOEt$” *read* “$CO{\cdot}COOH$.”
360	8*, 11*, and 15*	*for* “4” *read* “4′.”
387	2	*for* “indigotin” *read* “indican.”
427	20	,, “Abstr., 1899,” *read* “Abstr., 1898.”
489	21*	before “*acetaldehydedisulphonate*” insert “*brom.*”
498	20	*for* “(CH_2Et)” *read* “(CH_2Ph).”
512	17	,, “$C_{10}H_9N_4O$” *read* “$C_{10}H_9NO_4$.”
537	25	,, “strychnine” *read* “quinine.”
564	6, 7, and 8	,, “-phosphinic” *read* “-phosphinous.”
664	14*	,, “benzenesulphonic chloride (2 mols.) on ethylenediamine (1 mol.) in presence of an excess of,” *read* “trimethylene bromide on ethylenedibenzosulphonamide dissolved in.”
,,	9*	,, “$C_2H_3{:}$” *read* “$C_2H_4{:}$.”
696	16	,, “$\cdot NH{\cdot}C_6H_2Me_2$” *read* “$\cdot NH{\cdot}C_6H_2Me_3$.”
726	27	,, “$C_5H_9Cl{\cdot}OH$” *read* “$C_5H_9ClO_2$.”
736	19*	,, “ethylic” *read* “amylic.”
749	5* and 2*	,, “$\cdot NC_3H_6$” *read* “$\cdot NC_2H_4$.”
761	5	,, “$OH{\cdot}C_6H_4{\cdot}C(NHBz){:}CH{\cdot}COOH$” *read* “$OH{\cdot}C_6H_4{\cdot}CH{:}C(NHBz){\cdot}COOH$.”
766	12*	,, “(*methane*-1 : 2 : 6 : 8-*tetrol*)” read “(*menthane*-1 . 2 : 6 : 8-*tetrol*).”
798	3*	,, “*Phenylfurfurylamine*” read “*Phenylfurfurylcarbinylamine.*”
814	3	,, “*phenylglutarate*” read “*phenylglutarocarboxylate.*”
848	10*	,, “$C_2H_4(CH{:}CHMe)$” *read* “$C_2H_4(CH{:}CHMe)_2$.”
875	20*	,, “propylic” *read* “isopropylic.”
887	5*	,, “$NHPh{\cdot}CO{\cdot}NH_2R$” *read* “$NHPh{\cdot}CO{\cdot}NHR$.”
891	21	,, “-3-*dinitro*-” read “-3 : *ω-dinitro*-.”
917	8*	,, “*α-Dinaphthylbenzene*” read “*α-Dinaphthylbenzidine.*”

PART II.

5	16*	,, “1897, **28**,” *read* “1898, **27**.”
8	18*	,, “saumontite” *read* “laumontite.”
11	18	,, “SEIDENSTRAKER” *read* “SEIDENSTICKER.”
102	10	,, “Ph_3” *read* “PH_3.”
140	bottom	,, “CdC_2O” *read* “CdC_2O_4.”
159	,,	,, “WO_2” *read* “WO_3.”
278	11*	,, “YORRE” *read* “JORRE.”
290	19	,, “1895” *read* “1896.”
395	24	,, “atoms” *read* “equivalents.”
396	10	,, “has” *read* “is.”
401	15	,, “148 Cal.” *read* “14·8 Cal.”
,,	17	,, “43 Cal.” *read* “4·3 Cal.”
,,	18	,, “– 60 Cal.” *read* “– 6·0 Cal.”
,,	19	,, “– 17 Cal.” *read* “1·7 Cal.”
434	2*	,, “optically active” *read* “optically birefringent.”
436	3* and 7*	,, “Tachylite” *read* “Tachylyte.”
483	25	,, “**nitrate**” *read* “**nitrite**.”
503	21*	,, “**Fats**” *read* “**Fate**.”
545	9 and 14	,, “nitrogen” *read* “nitric oxide.”
684	18*	,, “acres” *read* “ares.”
725	22	,, “$Cd \mid CdCl_2 \mid Cl_2$” *read* “$Cd \mid CdCl_2 \mid Cl$.”
762	14	,, “JÓZSEF” *read* “JÓZEF.”

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* From bottom.

INDEX.

Page	Col.	Line	
1005	i	32*	*for* "YORRE" *read* "JORRE."
1043	i	27*	

COLLECTIVE INDEX (1883—1892).

Japp, *Francis Robert*, and *Edward* **Cleminshaw**, "constitution of glycocine," *should be* "glycosine."

"**Glucosine**, constitution of" (JAPP and CLEMINSHAW), *should be* "**Glycosine.**"

"**Tetraphenylglycocine**" *should be* "**Tetraphenylglycosine.**"

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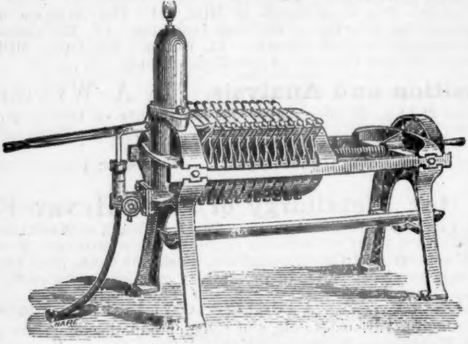

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